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AD NUMBER

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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 1122

3"/70 CALIBER GUN BARRELS
TEST AND DEVELOPMENT

57th Partial Report

...OVERY AND RANGE TEST OF 3"/5 AA PROJECTILES IN
3"/5/67 CALIBER GUN, TYPE A MOD 0 SERIAL NO. 1

Int. Partial Report

Task Assignment NOrd-Re5a-21-1-53

Copy No. 7

Classification CONFIDENTIAL
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NPG REPORT NO. 1122

Recovery and Range Test of 3"/15 AA Projectiles in 3"/15/67 Caliber Gun, Type A Mod 0 Serial No. 1

PART A

SYNOPSIS

1. A 3"/15/67 barrel, Type A Mod 0, and 3"/15 AA Projectiles, Type EX 1 Mod 0, were subjected to recovery and ranging tests. This barrel and projectile were designed as possible replacements for the 3"/70 barrel and projectile in 3"/70 gun systems, in view of difficulties experienced in the development of the latter.

2. The 3"/15/67 barrel - projectile combination performed very satisfactorily, as judged by both recovery and ranging tests. The mean corrected D/R for twenty (20) 5-round groups was 0.37%.

3. The performance supports the hypothesis that difficulties with the 3"/70 barrel - projectile combinations, which have been manifested in low accuracy, body engraving, and spiral wear, are ultimately due to band failure caused by the relatively large ratio of band diameter to body diameter necessary in the 3"/70 design.

4. Preliminary tests of nylon rotating bands for the 3"/15 projectile indicate that a workable design employing this material should not be a difficult problem.

5. It is recommended that the 3"/15/67 barrel used in these tests be fired for at least 1000 rounds to obtain additional data and information on wear characteristics of the gun. At the end of this program, recovery tests should be fired with projectiles having standard and shortened rotating bands.

[redacted]

NPG REPORT NO. 1122

Recovery and Range Test of 3"/15 AA Projectiles in 3"/15/67 Caliber Gun, Type A Mod 0 Serial No. 1

TABLE OF CONTENTS

Recovery and Range Test of 3"/5 AA Projectiles in 3"/5/67 Caliber Gun, Type A Mod 0 Serial No. 1

PART B

INTRODUCTION

1. AUTHORITY:

This program was authorized by references (a), (b), (c) and (d) and conducted under Task Assignments NPG-Re5a-21-1-52 and NPG-Re5a-21-1-53.

2. REFERENCES:

a. BUORD Conf ltr NP9 Re5a-FBW:cmj Ser 24896 of 27 Aug 1951 to NGF and NAVPROV
b. BUORD Conf ltr NP9 Re5a-JHM:cmj Ser 38482 of 29 Apr 1952 to NGF and NAVPROV
c. BUORD Conf ltr S74-1(3") Re5e-EOS:llh Ser 47851 of 18 Nov 1952 to NGF and NAVPROV
d. BUORD Conf ltr Re5a-FBW:fl NP9 of 3 Jul 1952
e. BUORD Conf ltr Re5a-FBW:cmj Ser 18945 of 3 Apr 1951 to NGF
f. FONECON between BUORD (Mr. Weathersbee, Re5a) and NAVPROV (LCDR W. B. Robertson) of 17 Mar 1952
g. BUORD Conf ltr Re5e-EOS:llh Ser 49062 of 12 Dec 1952 to NGF and NAVPROV
h. FONECON between NAVPROV (Mr. R. B. Butler) and BUORD (Mr. E. O. Stengard, Re5e) of 8 Dec 1952
i. BUORD Sk 232310, 3"/5/67 Gun Barrel and Chamber Details
j. BUORD Sk 328618, 3"/5 AA Projectile Type EX 1 Mod 0
k. BUORD Sk 238911 Dummy Nose Plug
l. NPG Ranging Data Sheet No. 1 of 12 Aug 1952
m. NPG Ranging Data Sheet No. 2 of 16 Jan 1953
n. NPG Report No. 896 of 29 Nov 1951

3. BACKGROUND:

The 3"/70 gun program throughout its course has been plagued with difficulties, the most crucial of which have been a strong tendency toward bad spiral wear of the barrel and a tendency toward poor accuracy. The belief has prevailed in some quarters, particularly at the Naval Proving Ground, that the basic cause of these difficulties was the unusually large diameter of the 3"/70 rotating band, as compared with the body diameter of the projectile, and that consequent band failure in the barrel at high velocity produced the observed phenomena.

Based on this hypothesis, the Bureau of Ordnance evolved the idea that a relatively small increase in projectile diameter, without a change in band diameter, would eliminate this possible cause of trouble. Such a projectile could be fired from a standard 3"/70 barrel bored to a slightly larger diameter, using the same cartridge case and other ammunition components as the 3"/70 gun. Furthermore, if the weight of the projectile were kept constant at 15 pounds, the increase in diameter would permit a corresponding decrease in length, which would increase the stability of the projecile in flight. Other advantages would be that, given the same fuze intrusion into the cavity as for the 3"/70, the larger projectile would permit loading more explosive around the fuze, which would tend to improve the fragmentation characteristics; and that the larger basal area of the modified projectile would permit a decrease of the service pressure without sacrifice of velocity.

As a result of these considerations, one (1) 3"15 gun barrel Type A Mod 0 and a supply of projectiles (EX-1 Mod 0) were designed and manufactured for experimental testing.

4. OBJECT OF TEST:

This test was conducted to obtain information on the performance of the 3"15/67 barrel - projectile combination, as determined from recovery and range firings. A small number of rounds with nylon rotating bands were also fired to obtain design information.

5. PERIOD OF TEST:

a.	Dates of Directives	27 August 1951 29 April 1952
b.	Date Test Commenced	25 March 1952
c.	Date Test Completed	16 January 1953

Recovery and Range Test of 3"/5 AA Projectiles in 3"/5/67 Caliber Gun, Type A Mod 0 Serial No. 1

PART C

DETAILS OF TEST

6. DESCRIPTION OF ITEMS UNDER TEST:

a. Gun: The 3"/5/67 gun barrel Type A Mod 0 Serial No. 1, manufactured in accordance with reference (e), has uniform depth-rifling similar in contour to that in the 3"/70 barrel Type G Mod 8. The bore diameter is 3"/5 and the groove diameter 3"/24. The chamber is also the same as in the Type G Mod 8 barrel except that the length from breech face to forward edge of the shell centering cylinder was changed to 25"/567 and the origin of bore located 3"/0 forward of this position. These two (2) points are connected by a 37"/5 radius tangent at the origin of bore. The bore and chamber are unplated. The exterior and breech face of the barrel are also the same as the Type G Mod 8 barrel. The twist is 1 turn in 23.8 calibers or one (1) turn in 75 inches. The rifling of the 3"/70 gun Type G Mod 8 also makes one (1) turn in 75 inches. By reference (a), proof pressure in this gun was set at 25 t.s.i.

b. Projectiles:

(1) 3"/5 AA Projectile Type EX 1 Mod 0 in accordance with reference (j), (Figures 1 and 28), loaded to 15 pounds total weight.

(2) 3"/5 AA Projectile Type EX 1 Mod 0 modified Type A, Figure 29, and modified Type B, Figure 30, loaded to 15 pounds total weight.

(3) 3"/5 AA Projectile Type EX 1 Mod 0 modified with two (2) "/75 nylon bands (Figures 1A and 32), loaded to 14.32 pounds total weight.

All projectiles were Epsom salts loaded and those fired for recovery were fitted with flat dummy nose plugs (Figure 33). All others were fired with standard pointed dummy nose plugs (reference (k)). The difference in weight between the nylon-banded and the standard projectiles represents the difference in weight between their bands.

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod 0 Serial No. 1

7. PROCEDURE AND RESULTS:

a. The first firing conducted in this gun was a combination of the proof of the gun and a recovery firing test. Six (6) 3"15 Projectiles Type EX 1 Mod 0 were fired in this test. Spin was determined by the wire impression method (Appendix (D)), and recovery was in sawdust. Before inert loading, the projectiles were measured in the cavity under the bands, for comparison with after recovery firing measurements, to check deformation resulting from band pressure. The data for the proof firing are included as Table I and for the recovery firing as Table IV (Appendix (A)). Photographs of the recovered rounds are included as Figures 2 to 6 (inclusive). The band engraving was excellent for all rounds with no apparent fringing or band wear. All rounds acquired full spin and the deformation under the band was -0"007 for the round with the maximum pressure (25 t.s.i.). Flight to the recovery bin was excellent.

The gun was then returned to the Naval Gun Factory for complete post-proof examination, star gauging and bore photography.

b. The Bureau of Ordnance requested in reference (b) that a charge be established for this gun-projectile combination, with powder index HKPC-1, at a muzzle velocity of 3400 ft./sec.. Twelve (12) rounds were inert loaded and fitted with standard nose plugs for this test. The mean of a five (5) round uniformity check with a 9.75 pound powder charge gave a velocity of 3411*9 ft./sec. and a crusher gauge pressure of 19.0 * 0.4 t.s.i. Detailed data are included as Table II.

The HKPC-1 powder, tested in 3"/70 guns, had given large velocity variations and reference (c) requested that a charge determination be fired with EX 6802 powder. Ten (10) Type EX 1 Mod 0 rounds were fired. The mean of a five (5) round uniformity check with a charge of 9.60 pounds gave 3402 * 4 ft./sec. velocity and 19.6 * 0.2 t.s.i. (mean of 4 rounds) pressure. Detailed data are included as Table III (Appendix (A)). This was better uniformity than with HKPC-1 powder, but because the quantity of EX 6802 on hand was insufficient, it was not used in the subsequent range tests (reference (g)). Photographs of the recovered projectiles are included as Figures 21-25 (incl).

c. The standard EX 1 Mod 0 projectile appeared to have more working metal in its bands than necessary (volume of metal above 3"15 diameter, 0.617 cu.in.) and reference (b) requested the Naval Proving Ground to reduce the working metal and fire a recovery program for band study. Two (2) modifications were tested; Type A with .510 cu.in. and Type B with .578 cu.in. of working metal. These modifications consisted of shortening the length of the cylindrical part of the two (2) bands. (See Figures 29 and 30.) Five (5) rounds of each modified type and four (4) of the unmodified projectiles were fired for recovery in this test. The detailed results are given in Table V (Appendix (A)), and photographs of the recovered projectiles are shown in Figures 7 to 20. All rounds had full spin, no yaw, and good band engraving without sign of fringing or appreciable band wear. Deformation under the bands was small for all three (3) types, being of course smaller for the shortened bands. No other difference was observed between the shortened and standard bands.

d. One (1) each of the three (3) types of projectile described above was crimped in a steel case, with a hand-rolled 360° crimp, for a debulleting test. Later, after modification of a 3"/70 rubber-hydraulic crimping machine to also accommodate 3"15 projectiles, one (1) round each was crimped in this manner for a similar test. The bullet pull forces are shown in Table VII (Appendix (A)), and run from 9,000 to 12,000 pounds.

e. Seven (7) nylon-banded 3"15 projectiles were prepared in accordance with Figure 32, using for the two (2) 3/4" bands nylon rings (Figure 31) which had been procured for use on 3" projectiles. These projectiles were hand-crimped in steel cases with the mouth of the case flush with the forward edge of the forward band, and fired for recovery. Detailed data are given in Table VI (Appendix (A)) and typical photographs of the recovered projectiles are shown in Figures 26 and 27. This rather improvised test gave encouraging results as full spin without yaw was attained. Only one (1) projectile retained one (1) of its bands upon recovery, but this was not unexpected as a more secure attachment is required to retain nylon band than was possible in this test.

f. The detailed results for the two (2) 50 round ranging programs, fired with standard MX 1 Mod 0 projectiles, were reported in references (l) and (m). Summaries of these are shown in Tables VIII and IX (Appendix (A)). The average corrected D/R (5-round groups) for the first ranging program was 0.33%; for the second 0.41%.

g. Star gauge readings on the gun at several stages in the tests are included in Appendix (C). After 156 ESR, there is no enlargement of the lands, but the grooves are worn by 0"002 - 0"004 throughout the length of the bore. (Measurement after decoppering could increase both of these figures slightly.)

8. DISCUSSION:

The performance of the 3"/15 barrel-projectile combination is considered to be most promising, and should receive serious consideration as a replacement for the 3"/70 barrel and projectile.

The appearance of the recovered projectiles indicated very satisfactory functioning of the bands, as regards to wear and centering, with the possibility that there may be more length of band than necessary. Spin was full, there was no body engraving, and the deformation of the projectile wall under the bands was small. The flight tests indicated very good accuracy. No 3"/70 barrel with twist as low as 1/25 has ever shown good range accuracy, except for the barrel fired with projectiles having an unconventional iron rotating band (reference (n)).

The fact that bands of shorter length showed as good behavior in the recovery firing as bands of full length may indicate that the band length on the 3"/15 projectile can be safely reduced, but firings in a worn gun would be necessary before a definite conclusion could be reached.

The test with nylon bands indicated feasibility of a band design employing this material. No difficulty is anticipated in designing a band to obturate, impart spin, and be retained in flight; in fact, it is felt that the major problem with such a design might well be the development of a sufficiently strong case attachment. There would be little use, however, of initiating such a development until rapid-fire testing of the design became possible.

Recovery and Range Test of 3"/5 AA Projectiles in 3"/5/67 Caliber Gun, Type A Mod 0 Serial No. 1

The groove wear observed in the gun is not surprising, considering that the diameter of the major portion of the band is 3".240 - 0".005, that the groove diameter at first gauging was 3".241, and that the deformation of the projectile under the band would increase the gap by another 0".005, approximately. Apparently the narrow high lip of this band acting alone does not furnish sufficient obturation at the bottom of the grooves. A decrease in groove diameter to 3".23 or 3".22 should be sufficient to correct this behavior, however.

PART D

CONCLUSIONS

9. It is concluded that:

a. The 3"/5/67 barrel-projectile combination performed very satisfactorily, as judged by both recovery and ranging tests. The mean corrected D/R for twenty (20) 5-round groups was 0.37%.

b. The performance supports the hypothesis that difficulties with the 3"/70 barrel-projectile combination, which have been manifested in low accuracy, body engraving, and spiral wear, are ultimately due to band failure caused by the relatively large ratio of band diameter to body diameter necessary in the 3"/70 design.

c. Preliminary tests of nylon rotating bands for the 3"/5 projectile indicate that a workable design employing this material should not be a difficult problem.

PART E

RECOMMENDATIONS

10. It is recommended that the 3"/5/67 barrel used in these tests be fired for at least 1000 rounds, to obtain more range data and information on wear characteristics of the gun. At the end of this program, recovery tests should be fired with projectiles having standard and shortened rotating bands.

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod 0 Serial No. 1

- -

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By direction

CONFIDENTIAL

NPG REPORT NO. 1122

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Fifty-seventh Partial Report

on

3"/70 Caliber Gun Barrels

Test and Development

- -

First Partial Report

on

Recovery and Range Test of 3"15 A4 Projectiles in

3"15/67 Caliber Gun, Type A Mod 0 Serial No. 1

Project No.: NPG-Re5a-21-1-53
Copy No.: 7
No. of Pages: 10

Date: MAY 18 1953

CONFIDENTIAL
SECURITY INFORMATION

FIRING REPORT
PROC-RPC-69

'AL PROVING GROUND
DAHLGREN, VA.
TABLE I

OTF:RDC:lah
A11/5001-1
Ser ~~20977~~

From: Commander, Naval Proving Ground

DATE 8 April 1952

To: Chief of the Bureau of Ordnance

Subject: Proof of 3"/15/67 Inch Gun Barrel Type A Mod 0 No. 1

Reference: BUORD ltr. Re5a-FBW:cmj Ser 24896 of 27 August 1951

FIRING OFFICER R. D. Cromwell USN

UNIT	MAKER	MARK	MOD	NUMBER
GUN	NGF	A	0	1
HOUSING	NGF Previously Proved	1	3	486
MOUNT	Previously Proved	22	--	---
SLIDE	Rhode Island Arsenal Previously Proved	21	8	3507
CARRIAGE	NGF Previously Proved	25	24	4220
STAND	NGF Previously Proved	14	9	4095
HYDRAULIC RAMMER	None			

ROUND	SHELL SEATING	ELEV.	RECOIL	C. R.	CHARGE LBS.	CHARGE GMS.	POWDER DESIGNATION	POWDER TEMP.	PRESSURE	VELOCITY	HOW FIRED
1	Case	0°	9"25	Full	9.0	--	HKPC-1	90°	15.4	3128	
2	"	"	9"75	"	10.0	--	"	"	18.8	3463	
3	"	"	9"75	"	10.7	--	"	"	22.2	3603	
4	"	"	9"75	"	11.2	--	"	"	23.8	3760	
5	"	"	10"0	"	11.4	--	"	"	25.0	3799	
6	"	"	9"75	"	10.4	--	"	"	21.4	3566	
7											
8											
9											
10											
11											
12											

DATE OF TEST 25 March 1952

DATE OF RECEIPT 13 February 1952

PREVIOUS ROUNDS 0

ROUNDS DURING THIS TEST 6

TOTAL ROUNDS ON STATION ACTUAL 6

EQUIV. SER. 9.70

NGF (12)

IRVING T. DUKE

R. T. RUBLE
By direction

APPENDIX (A)

PROC-1-17-60-10M

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod C Serial No. 1

TABLE II

CHARGE DETERMINATION FOR 3"15/67 CALIBER GUN - HKPC-1

GUN FIRING CONDITIONS:

Gun:	Type A Mod 0 No. 1
Projectiles:	EX 1 Mod 0 (15.00 lbs.) Epsom Salts loaded
Case:	Ex. No. 5 Steel, Rubber Crimped
Primer:	Mk 46 (XC-M11)
Wad and Spacer:	Cardboard, NGF Dwg. No. 132664, Pc. Nos. 13 and 4
Powder:	HKPC-1
Lead Foil:	None
Temperature:	90°F

CHARGE DETERMINATION:

Rd. No.	Charge (lbs.)	PPD (in.)	Velocity (ft./sec.)	Pressure (t.s.i.)	Flash (%)	Smoke (%)
1(a)	9.00	4.3	3206	16.4	0	150
2	"	"	3242	15.9	0	150
3	"	"	3228	16.3	0	150
4	"	"	3256	16.4	0	150
	Mean of 3 rounds		3242±14	16.2±0.2		
5	9.50	2.5	3355	19.0	0	150
6	9.75	2.1	3427	20.0	0	150
7	"	"	3417	18.9	0	150
8	"	"	3405	18.6	0	150
9	"	"	3396	18.7	0	150
10	"	"	3411	19.0	0	150
	Mean of 5 rounds		3411±9	19.0±0.4		
11	10.00	2.1	3475	20.5	0	150
12	9.00	4.3	3239	16.1	0	150

(a) Conditioning round - not used.

UNIFORMITY:

Charge (lbs)	PPD (in.)	Velocity (ft./sec.)	Pressure (t.s.i.)	No. of Rds.
9.00	4.3	3242±14	16.2±0.2	3
9.75	2.1	3411±9	19.0±0.4	5

Charge obtained for 3400 ft./sec.

Charge (lbs.)	Velocity (ft./sec.)	Pressure (t.s.i.)
9.70	3400	18.80

TABLE III

CHARGE DETERMINATION FOR 3"15/67 CALIBER GUN - EX-6802

GUN FIRING CONDITIONS:

Gun:	3"15/67 Caliber, Type A, Mod 0, No. 1
Projectile:	EX 1 Mod 0 (15.00 lbs.) Epsom Salts Loaded
Case:	Mk 10, Steel, Rubber Crimped
Primer:	Mk 46 (XC-M11)
Wad and Spacer:	Cardboard, NGF Dwg. 132664, Pc. Nos. 13 and 4
Powder:	EX-6802
Lead Foil:	None
Powder Temp.:	90°F
Date:	12-22-52

CHARGE DETERMINATION:

Rd. No.	Charge (lbs.)	PPD (in.)	Velocity (ft./sec.)	Pressure (t.s.i.)
1 (a)	9.00	5.4	3197	16.7
2	9.00	5.4	3237	16.1
3	"	"	3233	16.3
Mean of 2 rounds	9.00	5.4	3235±2	16.2±0.1
4	9.80	2.6	3466	20.3
5	10.00	2.2	3505	20.8
6	9.60	3.6	3408	19.6
7	9.60	"	3404	19.3
8	9.60	"	3403	19.9
9	9.60	"	3398	19.7
10	9.60	"	3396	-
Mean of 5 rounds	9.60	3.6	3402±4	19.6±0.2 (b)

(a) Conditioning round
(b) Average of 4 rounds

UNIFORMITY:

Powder	Charge (lbs.)	PPD (in.)	Velocity (ft./sec.)	Pressure (t.s.i.)	No. of Rds.
EX-6802	9.00	5.4	3235±2	16.2±0.1	2
EX-6802	9.60	3.6	3402±4	19.6±0.2(b)	5

(b) Average of 4 rounds

RECOMMENDED CHARGE FOR 3400 FT./SEC. NOMINAL VELOCITY:

Powder	Charge (lbs.)	PPD (in.)	Pressure (t.s.i.)
EX-6802	9.59	3.6	19.5

TABLE IV

COMPLETE BEFORE AND AFTER RECOVERY FIRING DATA

Test of 3"/15 Projectiles Type EX 1 Mod 0 in 3"/15/67 Gun Type A Mod 0 No. 1

Proj. No.	Firing Order 3/25/52	Powder Charge (lbs.) HPC-1	Average Pressure (t.s.i.)	Muzzle Velocity (ft./sec.)	% Nominal Spin	Deformation (in.) Overall Length	I.D. under after edge of high lip in forward band	I.D. under forward band midway of flat	Remarks
1094	1	9.0	15.4	3128	99.6	-.002	-.006	-.006	No Yaw
1095	2	10.0	18.8	3463	100.2				No Yaw
1096	3	10.7	22.2	3603					No Yaw Broke in Recovery Bin.
1097	4	11.2	23.8	3760	100.4	.000	-.007	-.007	No Yaw
1098	5	11.4	25.0	3799	100.7	-.001	-.004	-.007	No Yaw
1099	6	10.4	21.4	3566	100.3	-.001	-.003	-.006	No Yaw

Gun Type A Mod 0 No. 1 had 0 ESR at start of this firing.
Standard Projectiles Type EX 1 Mod 0.

TABLE V

COMPLETE BEFORE AND AFTER RECOVERY FIRING DATA

Test of 3"/15 Projectiles Type EX 1 Mod 0 in 3"/15/67 Gun Type A Mod 0 No. 1

Proj. No.	Firing Order 7/1/52	Proj. Type & Mod	Powder Charge (lbs.) HKPC-1	Average Pressure (t.s.i.)	Muzzle Velocity (ft./sec.)	% Nominal Spin	Deformation (in.) I.D. under after edge of high lip in forward band	Deformation (in.) I.D. under center of hoist clamp groove
1408	1	Standard	9.7	18.1	3326	100.3	-.006	-.001
1409	2	A	10.6	20.9	3573	100.7	-.002	.000
1410	3	A	10.6	21.8	3601	100.4	+.001	+.003
1411	4	B	10.6	22.2	3576	100.4	-.001	+.002
1412	5	B	10.6	21.7	3557	100.2	-.005	-.003
1413	6	Standard	9.7	19.8	3405	100.3	-.009	-.006
1414	7	Standard	9.7	17.9	3350	100.5	-.008	-.006
1415	8	Standard	9.7	18.2	3354	100.5	-.007	-.007
1416	9	A	9.7	19.1	3398	100.3	-.001	-.001
1417	10	A	9.7	18.4	3361	100.3	-.003	-.001
1418	11	A	9.7	18.4	3363	101.3	+.002	+.001
1419	12	B	9.7	18.6	3365	100.8	-.004	-.004
1420	13	B	9.7	17.5	3344	100.5	-.006	-.002
1421	14	B	9.7	18.3	3366	99.9	-.002	-.001

Gun Type A Mod C No. 1 had 9.7 ESR at start of this firing.
Standard - Type EX 1 Mod 0 Projectiles.
Mod A - Projectiles Type EX 1 Mod 0 Modified according to APL-342.
Mod B - Projectiles Type EX 1 Mod 0 Modified according to APL-343.

TABLE VI

COMPLETE BEFORE AND AFTER RECOVERY FIRING DATA

Test of 3"/15 Projectiles Type EX 1 Mod 0 in 3"/15/67 Gun Type A Mod 0 No. 1

Proj. No.	Firing Order 12/22/52	Proj. Type & Mod	Powder Charge (lbs.)	Average Pressure (t.s.i.)	Muzzle Velocity (ft./sec.)	% Nominal Spin	Deformation (in.) I.D. under after edge of high lip in forward band	Deformation (in.) I.D. under forward band midway of flat
			EX 6802					
2013	6	Standard	9.60	19.6	3408	99.2	-.004	-.006
2014	7	Standard	9.60	19.3	3404	98.3	-.003	-.005
2015	8	Standard	9.60	19.9	3403	98.4	-.005	-.007
2016	9	Standard	9.60	19.7	3398	99.5	-.005	-.009
2017	10	Standard	9.60	17.7	3396	97.6	-.004	-.006
2018	11	Nylon Banded	HKPC-1 9.50	16.1	3343	Fired down river		
2019	12	"	9.75	17.3	3377	98.3		
2020	13	"	10.0	17.5	3467	97.4		
2021	14	"	10.0	16.7	3359	98.9		
2022	15	"	10.0	18.5	3469	97.4		
2023	16	"	10.0	16.0	3403	98.3		
2024	17	"	10.0	16.0	3388	97.0		

Gun Type A Mod 0 No. 1 had 88 ESR at start of this firing.
Rounds 1 thru 5 were fired down river for charge determination.
Standard Type EX 1 Mod 0 Projectiles.
Nylon Banded Type EX 1 Mod 0 Projectiles according to APL-424.

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod 0 Serial No. 1

TABLE VII

DEBULLETING TESTS RESULTS

Projectile	Bullet pull (lbs.) Hand Crimped	Bullet pull (lbs.) Rubber-hydraulic Crimped
EX 1 Mod 0	12,080	11,820
EX 1 Mod 0 (A modification)	11,900	10,440
EX 1 Mod 0 (B modification)	11,340	9,260

TABLE VIII

RANGE AND EROSION TEST OF 3"15/67 CALIBER GUN TYPE A MOD 0 SERIAL NO. 1

Summary of Results of Ranging and Erosion Tests of 3"15/67 Caliber Gun Type A Mod 0 Serial No. 1 using Projectiles Type EX 1 Mod 0, Reported in Detail on NPG Ranging Data Sheet No. 1 of 12 August 1952

Elevation: 15 degrees
Propellant: 9.70 lbs. Index HKPC-1
Projectile Loading: Epsom Salts
Nose: DNP 238911
Projectile: Type EX 1 Mod 0

Gun Data: 3"15/67 Caliber Type A Mod 0 Serial No. 1
Rifling - 1 turn in 23.81 Calibers, Uniform Twist.
Rounds before test: 32 actual rounds
37.20 ESR
△Do C"CC6 ESR: 9.84

Rds. Fired	Rds. Ranged	Rd. Nos. in Program	Muzzle Velocity (ft./sec.)	Uncorrected Range (yds.)	Uncorrected Drift (yds.)	Corrected Range (yds.)	Uncorrected D/R (%)	Corrected D/R (%)
5	5	2-6	3422±7	13979±38	-15±11	13469±23	0.27	0.17
5	5	7-11	3433±23	14023±100	- 5±10	13462±14	0.71	0.10
5	5	12-16	3421±20	13984±80	- 4±5	13476±33	C.57	0.24
5	5	17-21	3410±14	13877±73	- 2±17	1342C±38	C.53	0.28
5	5	22-26	3414±21	13921±87	16±6	13445±34	0.62	0.25
5	5	27-31	3414±7	13849±39	2±11	13372±42	0.28	C.31
5	5	32-36	3425±21	13838±74	0±9	13319±57	C.53	C.43
5	5	37-41	3428±15	13838±37	12±15	1330C±35	0.27	C.26
5	5	42-46	3414±8	1379C±75	25±9	13312±45	0.54	C.34
5	5	47-51	3443±24	13769±29	36±21	13161±122	0.21	C.93

Note: Rd. #50 had a muzzle velocity of 3483 ft./sec. and a corrected range of 129C6 yds. causing the corrected D/R (%) for this 5 rd. group to be C.93.

TABLE IX

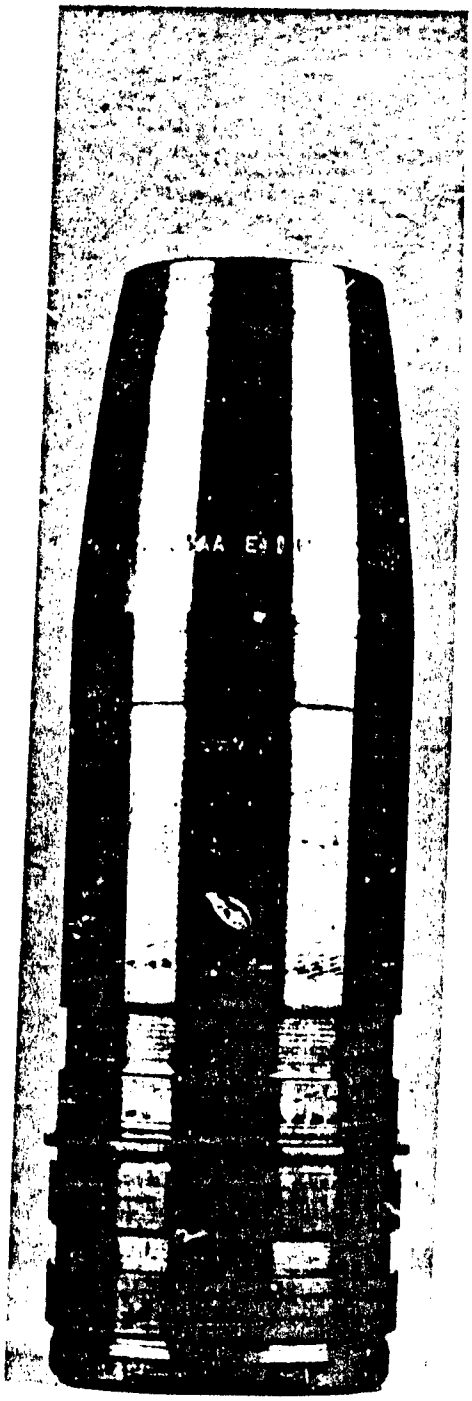
RANGE AND EROSION TEST OF 3"15/67 CALIBER GUN TYPE A MOD 0 SERIAL NO. 1

Summary of Results of Ranging and Erosion Tests of 3"15/67 Caliber Gun Type A Mod C Serial No. 1 using Projectile Type EX 1 Mod 0, reported in detail on NPG Ranging Data Sheet No. 2 of 16 January 1953.

Elevation: 15 degrees
Propellant: 9.70 lbs. Index HKPC-1
Projectile loading: Epsom Salts
Nose: DNP 238911
Projectile: Type EX 1 Mod 0

Gun Data: 3"15/67 Caliber Type A Mod C Serial No. 1
Rifling - 1 turn in 23.81 Calibers, Uniform Twist.
Rounds before test: 100 actual rounds
105.53 ESR
△Do C"CC5 ESR: 105.53

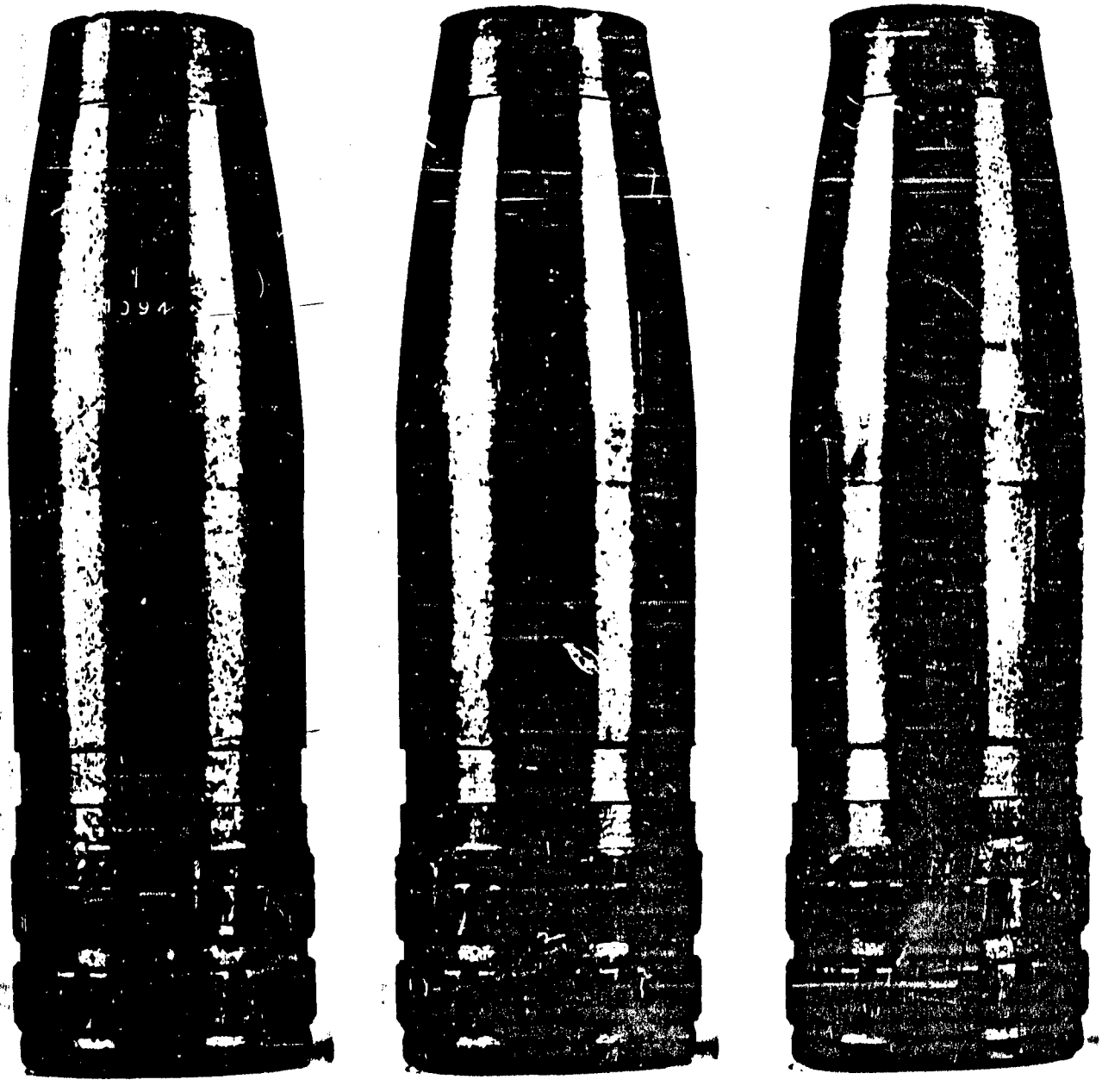
Rds. Fired	Rds. Ranged	Rd. Nos. in Program	Muzzle Velocity (ft./sec.)	Uncorrected Range (yds.)	Uncorrected Drift (yds.)	Corrected Range (yds.)	Uncorrected D/R (%)	Corrected D/R (%)
5	5	2-6	3398±14	13644±30	-40±7	13471±42	C.22	C.31
5	5	7-11	3413±22	13677±69	-25±6	13445±24	C.50	C.18
5	5	12-16	3421±19	13668±92	-45±7	13407±45	C.67	C.34
5	5	17-21	3390±20	13555±94	-35±5	13424±26	C.69	C.19
5	5	22-26	3408±22	13612±79	-46±7	13411±32	C.58	C.24
5	5	27-31	3410±14	13543±89	-55±10	13322±59	C.66	C.44
5	5	32-36	3418±17	13621±46	-51±11	13354±88	C.34	C.66
5	5	37-41	3416±8	13577±54	-59±17	13319±69	C.40	C.52
5	5	42-46	3400±12	13509±34	-57±16	13332±68	C.25	C.51
5	5	47-51	3427±24	13524±50	-68±27	13220±103	C.37	C.78



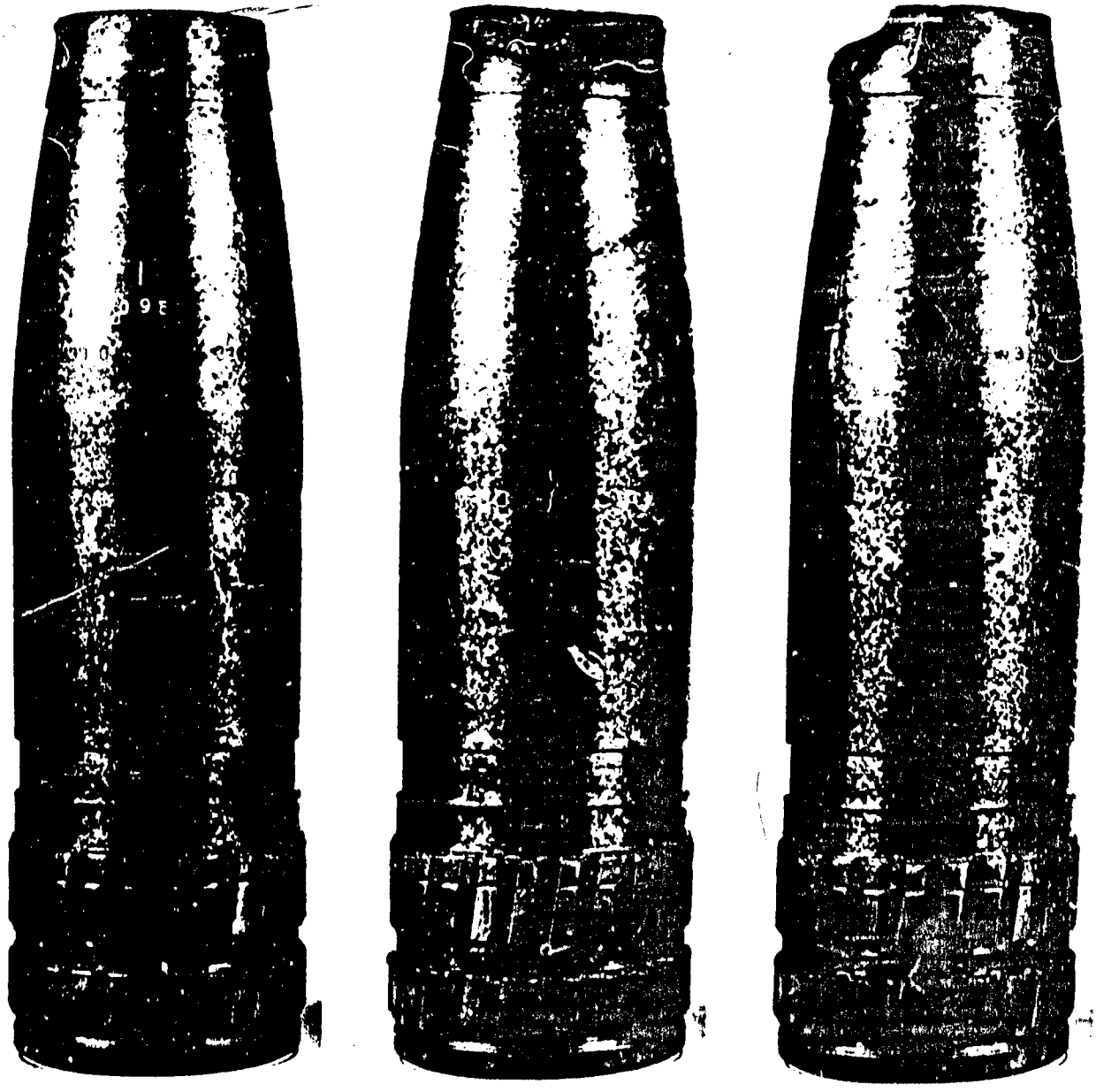
3"15 AA Projectile Type EX 1 Mod 0 before firing.
Figure 1

NP9-51579 22 December 1952 CONFIDENTIAL
SECURITY INFORMATION

3"/5 AA Projectile with two 0"/75 Nylon Bands before Firing.
Figure 1A

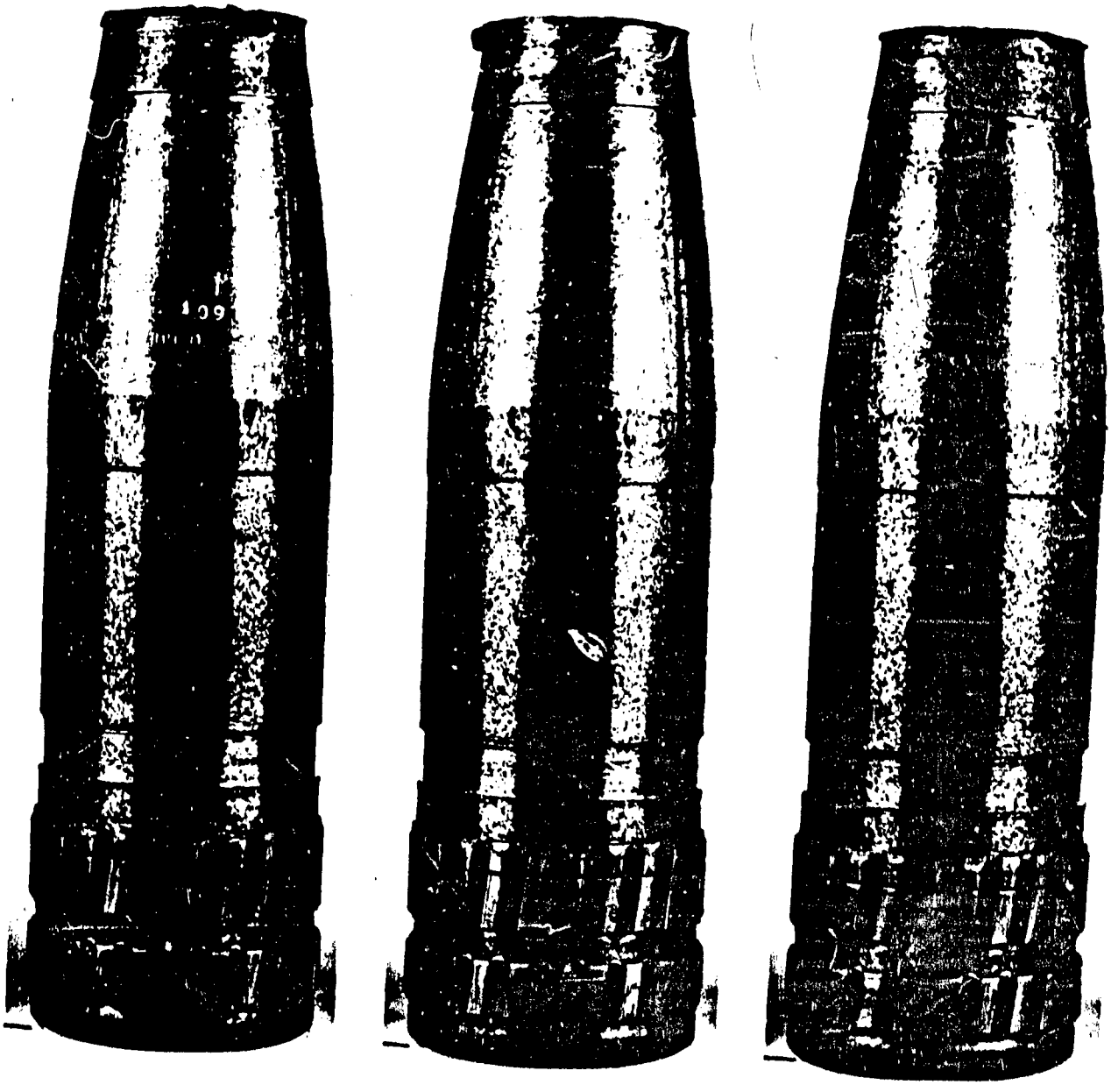


Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0. Projectile No. 1094 (muzzle velocity 3128 ft./sec.).
Figure 2



NP9-50941 25 March 1952 CONFIDENTIAL SECURITY INFORMATION

Three views (120° apart) of recovered 3"15 AA Projectile Type EX 1 Mod 0. Projectile No. 1095 (muzzle velocity 3463 ft./sec.)
Figure 3

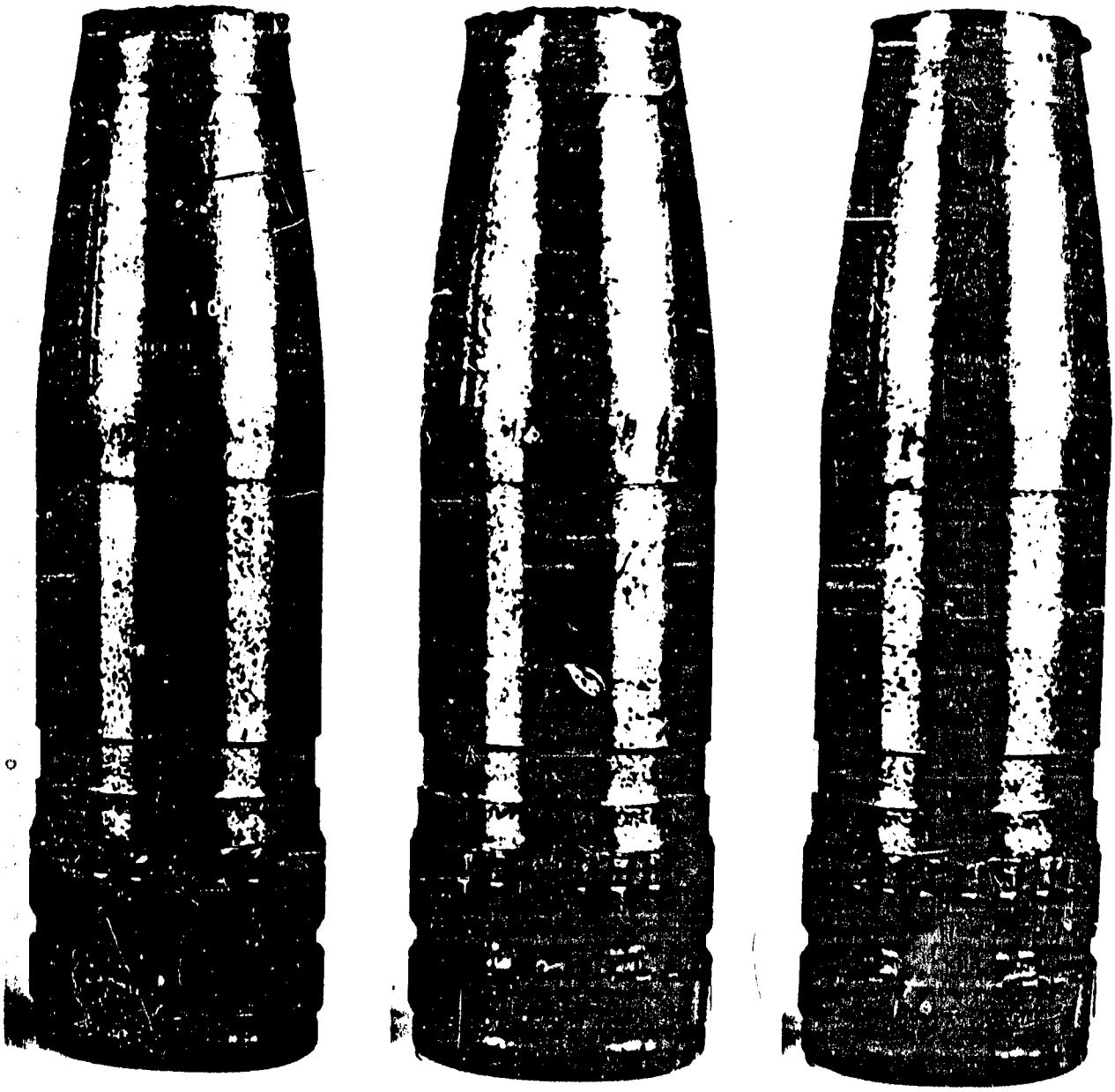


NP9-50942

25 March 1952

CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0. Projectile No. 1097 (muzzle velocity 3760 ft./sec.).
Figure 4



NP9-50943

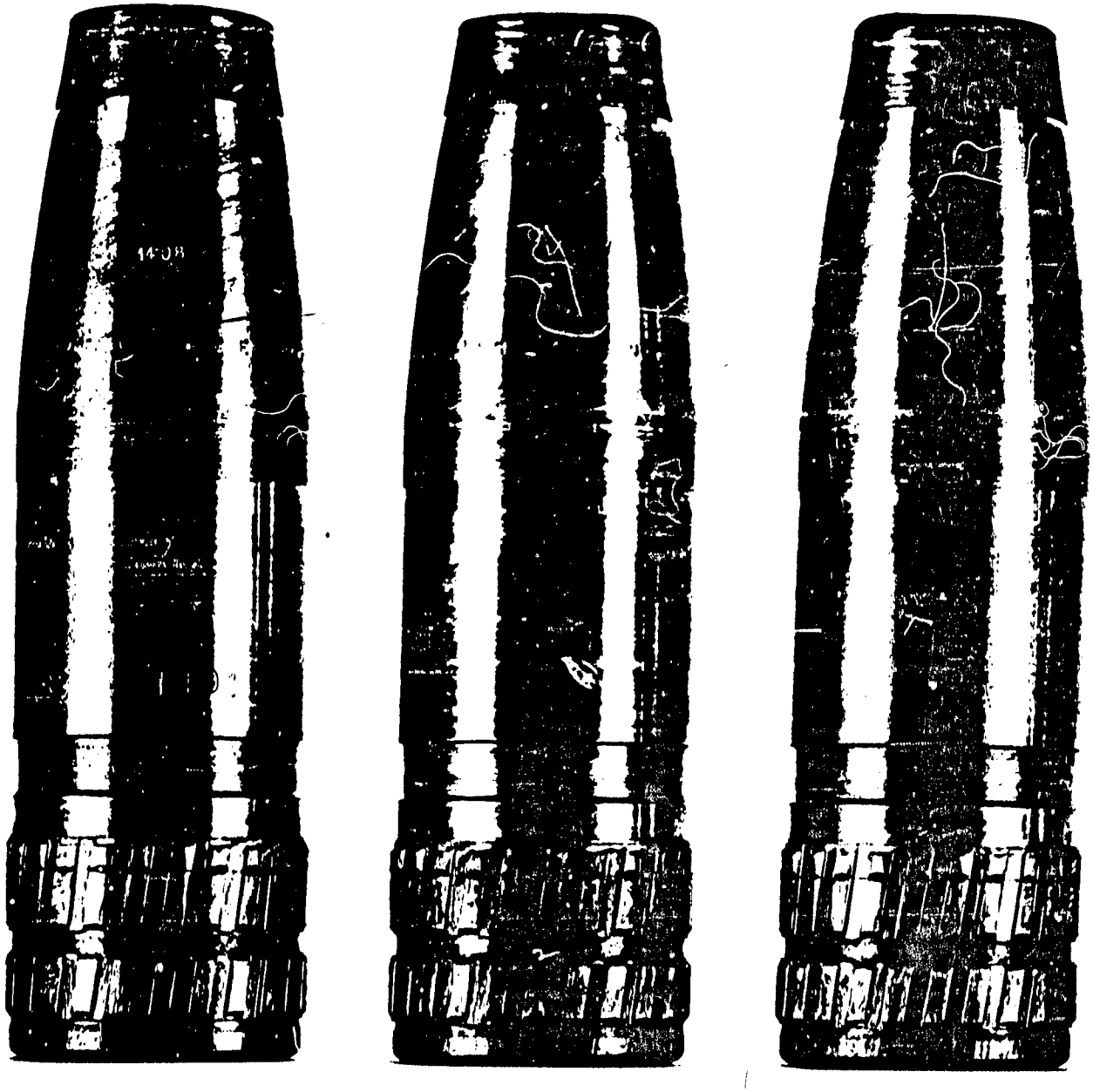
25 March 1952

CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0. Projectile No. 1098 (muzzle velocity 3799 ft./sec.).
Figure 5

NP9-50944 25 March 1952 CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0. Projectile No. 1099 (muzzle velocity 3566 ft./sec.).
Figure 6



NP9-50945 1 July 1952 CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"15 AA Projectile Type EX 1 Mod 0. Projectile No. 1408 (muzzle velocity 3326 ft./sec.).
Figure 7

NP9-50946 1 July 1952 CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"/5 AA Projectile Type EX 1 Mod 0 (Type A Modification). Projectile No. 1409 (muzzle velocity 3573 ft./sec.).

Figure 8

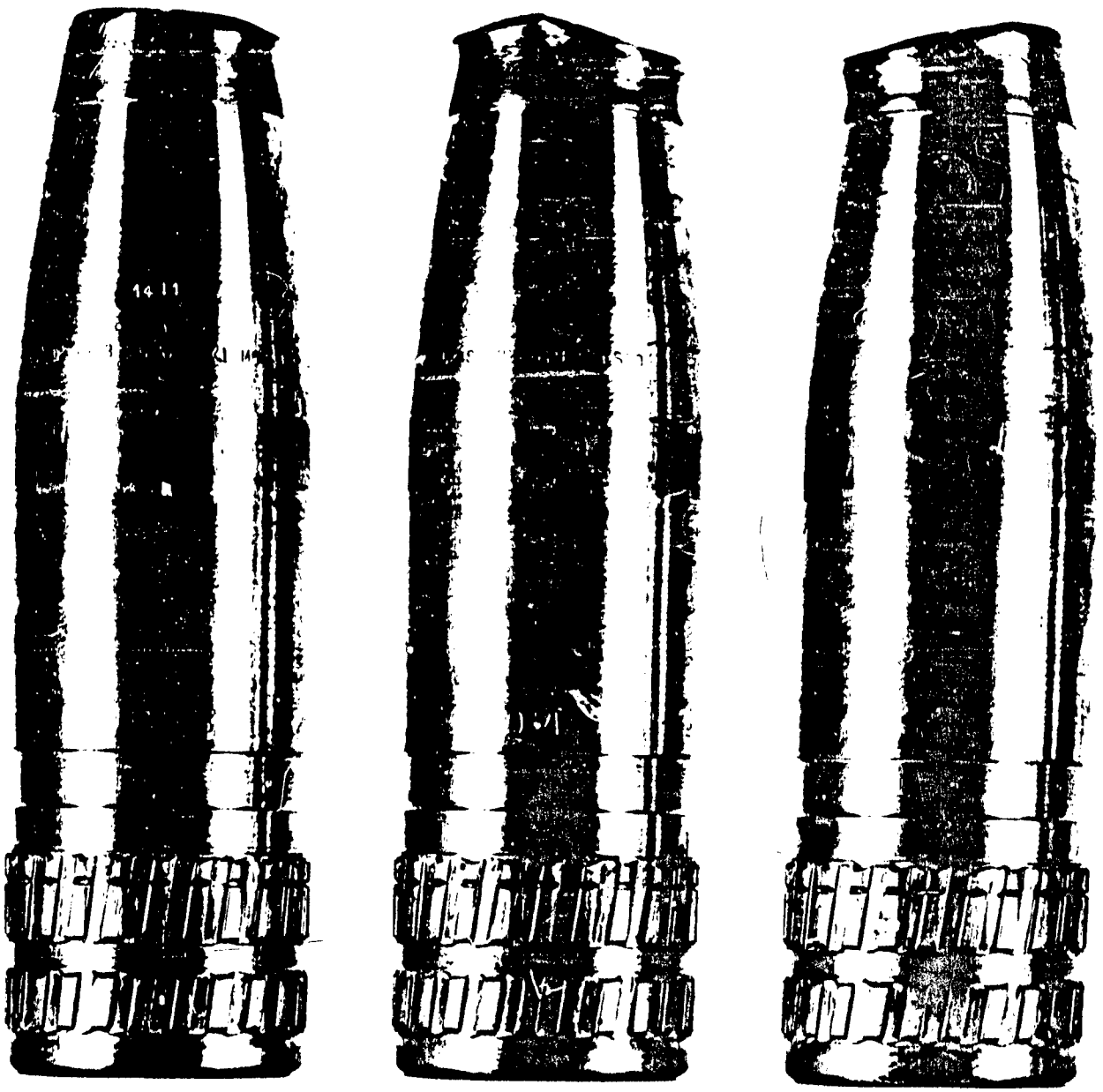
NP9-50947

1 July 1952

CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"/15 AA Projectile Type FX 1 Mod 0 (Type A Modification). Projectile No. 1410 (muzzle velocity 3601 ft./sec.).

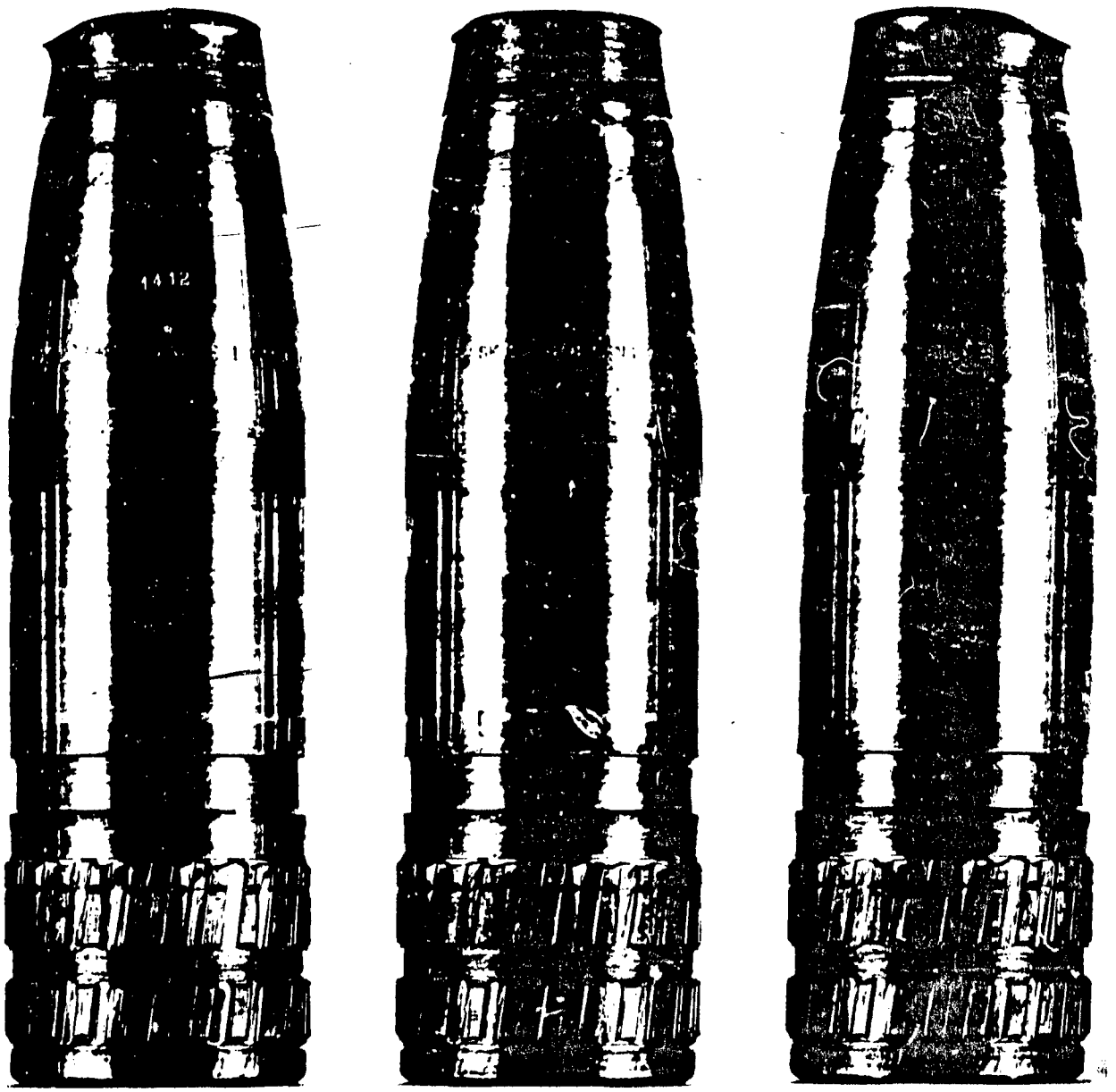
Figure 9



NPG-50948 1 July 1952 CONFIDENTIAL SECURITY INFORMATION

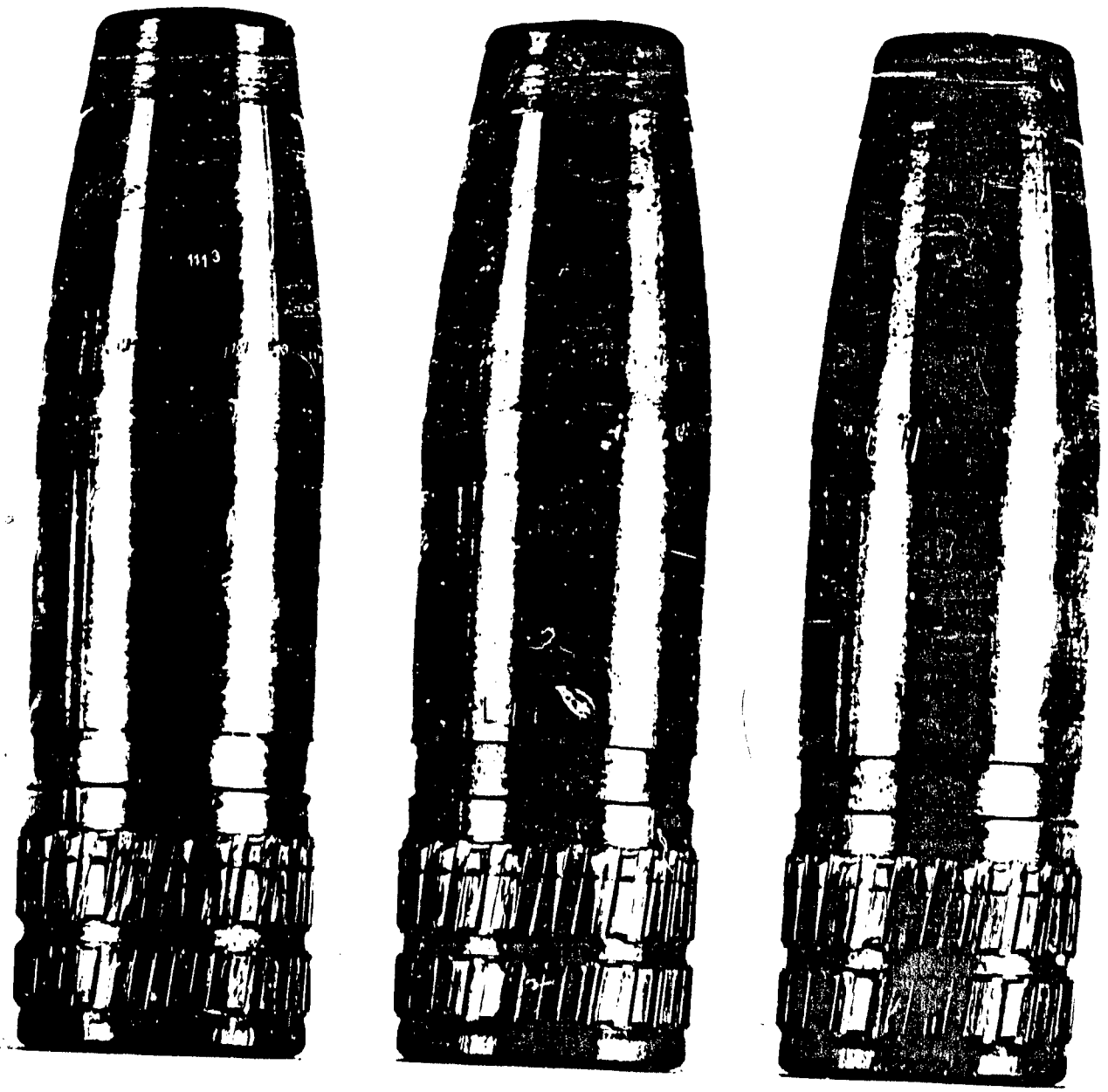
Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0 (Type B Modification). Projectile No. 1411 (muzzle velocity 3576 ft./sec.).

Figure 10



Three views (120° apart) of recovered 3"15 AA Projectile Type EX 1 Mod 0 (Type B Modification). Projectile No. 1412 (muzzle velocity 3557 ft./sec.).

Figure 11



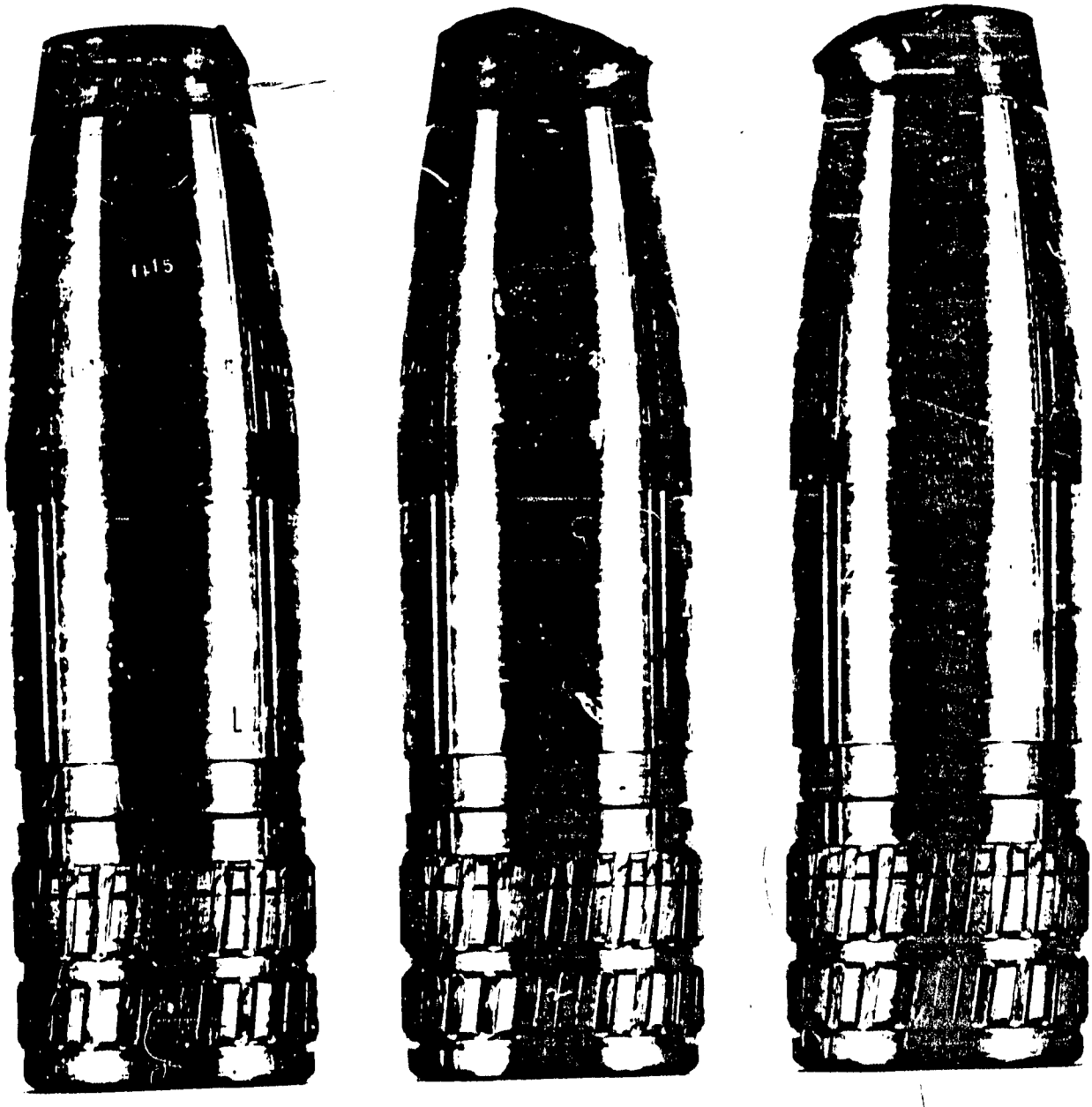
NP9-50950

1 July 1952

CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"15 AA Projectile Type EX 1 Mod 0. Projectile No. 1413 (muzzle velocity 3405 ft./sec.).
Figure 12

Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0. Projectile No. 1414 (muzzle velocity 3350 ft./sec.).
Figure 13



NP9-50952 1 July 1952 CONFIDENTIAL SECURITY INFORMATION

Three views (120° apart) of recovered 3"15 AA Projectile Type EX 1 Mod 0. Projectile No. 1415 (muzzle velocity 3354 ft./sec.).
Figure 14

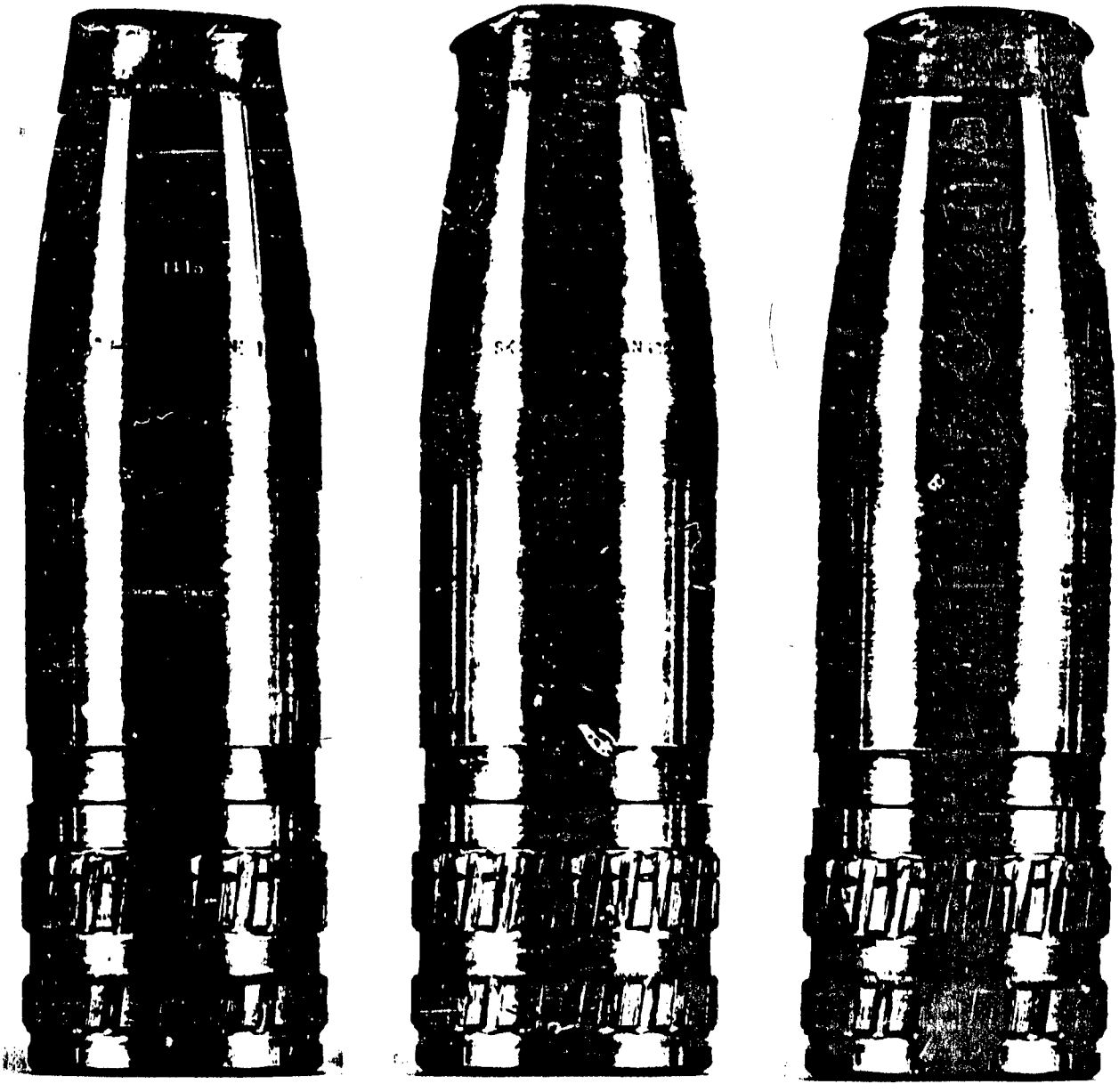
Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0 (Type A Modification). Projectile No. 1416 (muzzle velocity 3398 ft./sec.)

Figure 15

NP9-50954 1 July 1952 CONFIDENTIAL
SECURITY INFORMATION

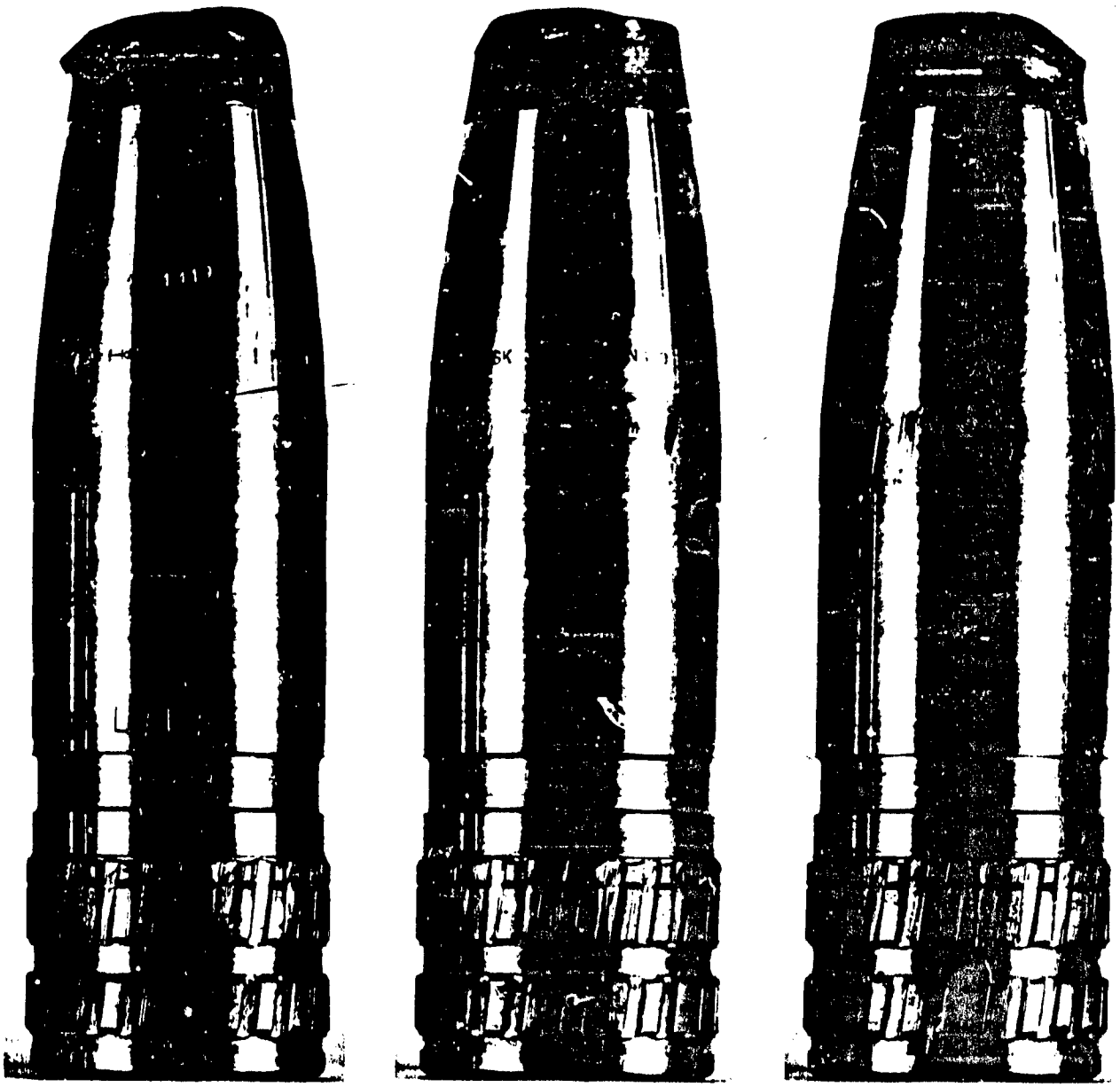
Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0 (Type A Modification). Projectile No. 1417 (muzzle velocity 3361 ft./sec.).

Figure 16



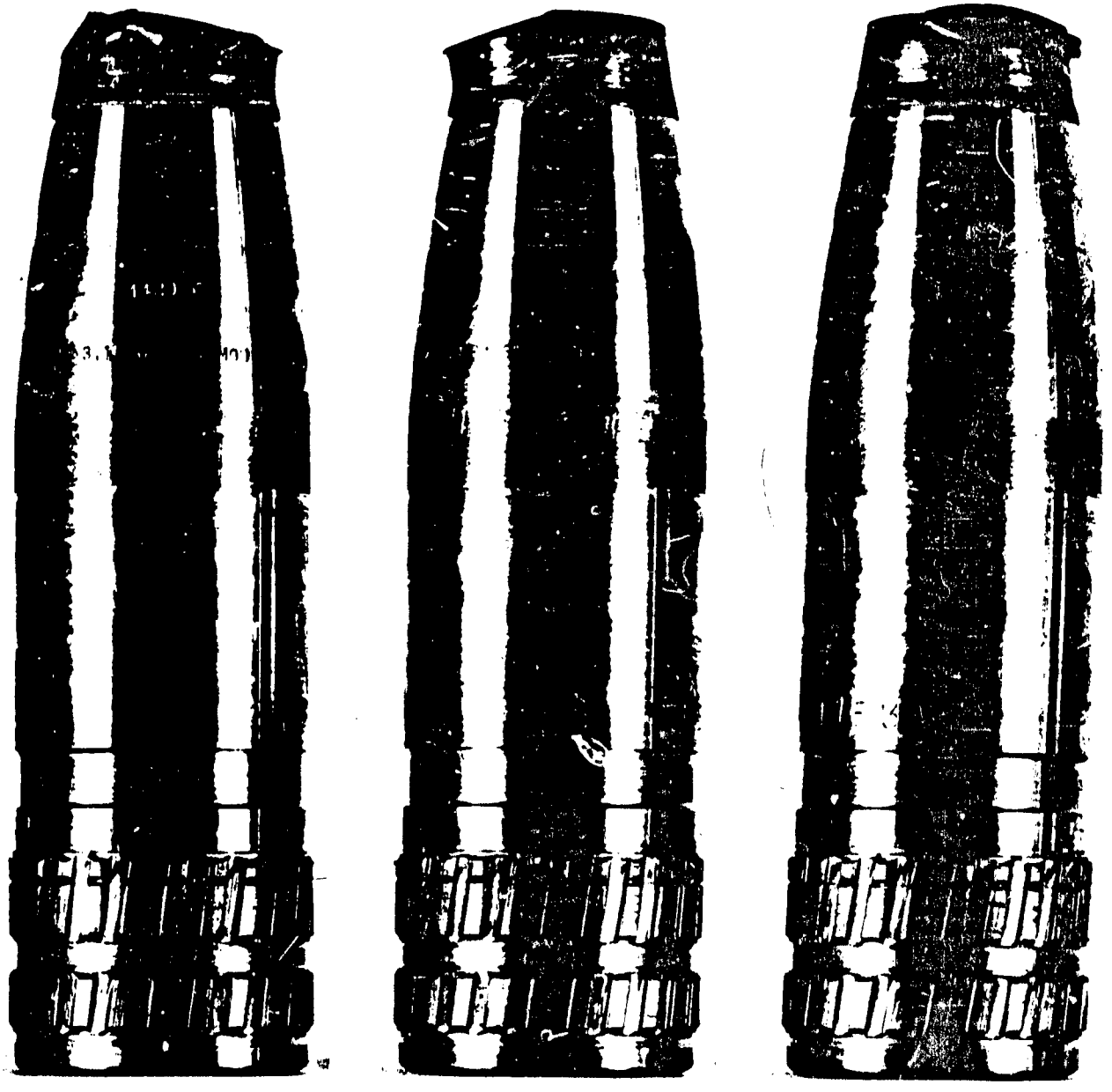
Three views (120° apart) of recovered 3"15 AA Projectile Type EX 1 Mod 0 (Type A Modification). Projectile No. 1418 (muzzle velocity 3363 ft./sec.).

Figure 17



Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0 (Type B Modification). Projectile No. 1419 (muzzle velocity 3365 ft./sec.).

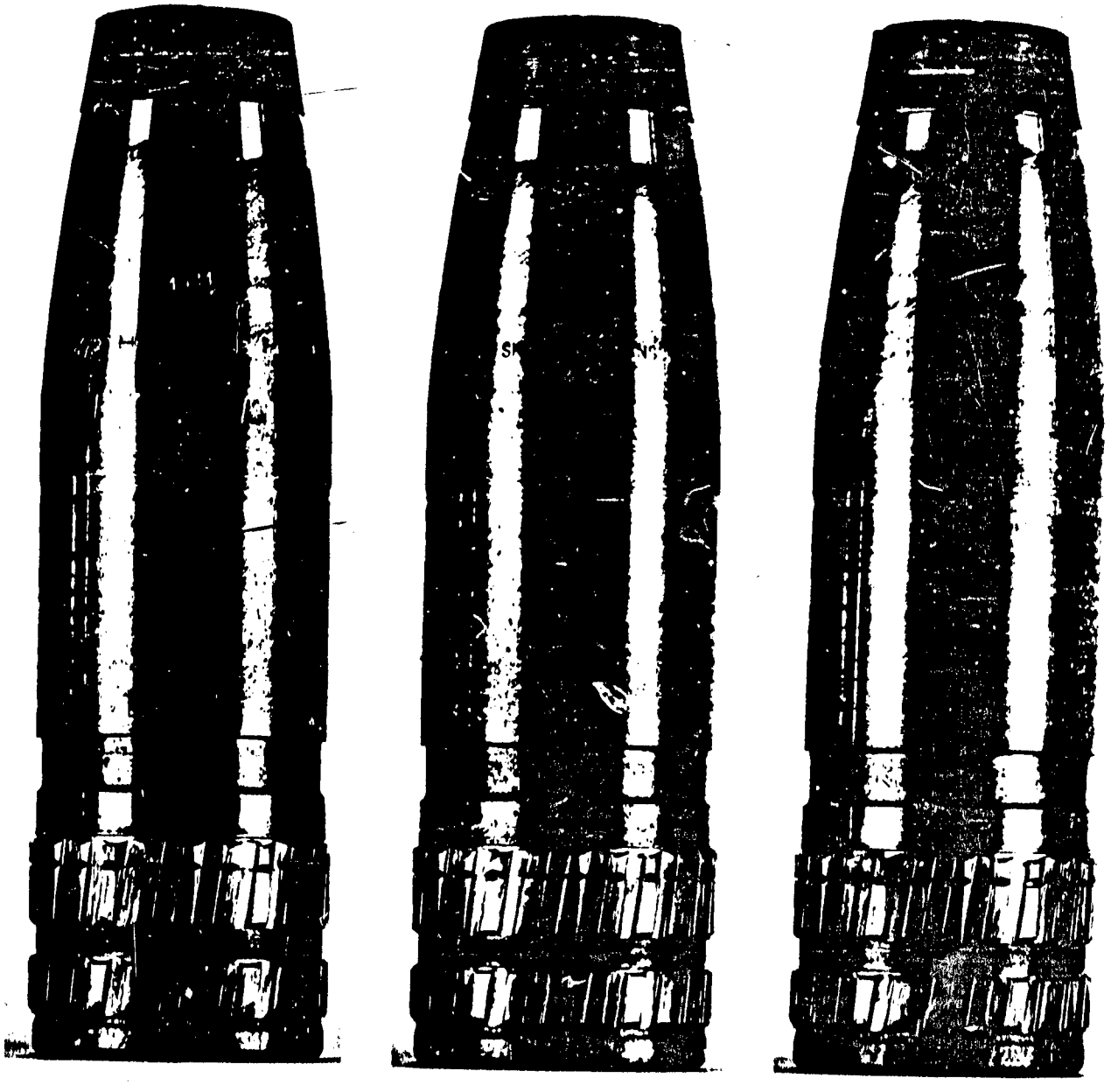
Figure 18



NP9-50957 1 July 1952 CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0 (Type B Modification). Projectile No. 1420 (muzzle velocity 3344 ft./sec.).

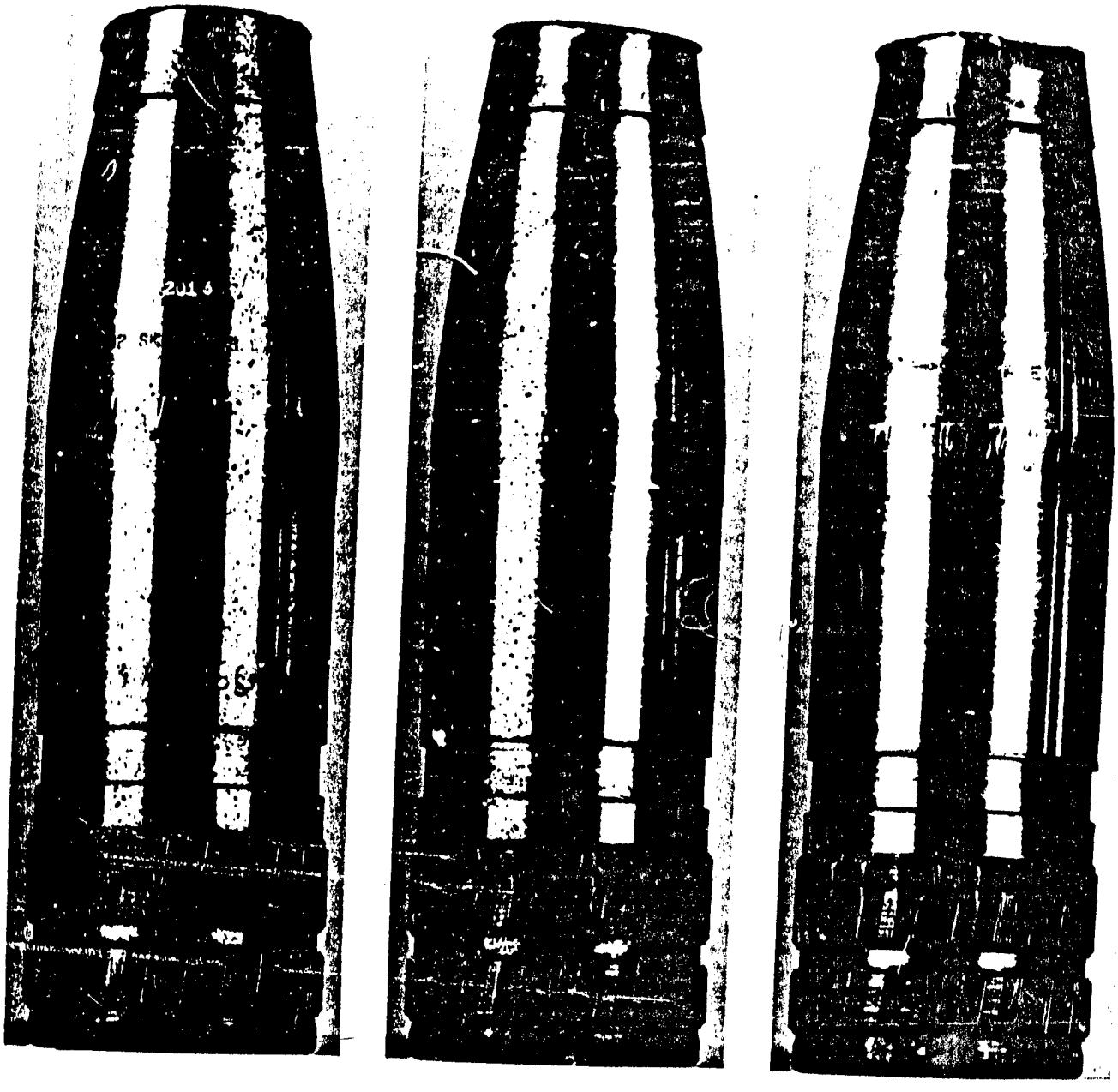
Figure 19



NP9-50958 1 July 1952 CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0 (Type B Modification). Projectile No. 1421 (muzzle velocity 3366 ft./sec.).

Figure 20



NP9-51562

22 December 1952

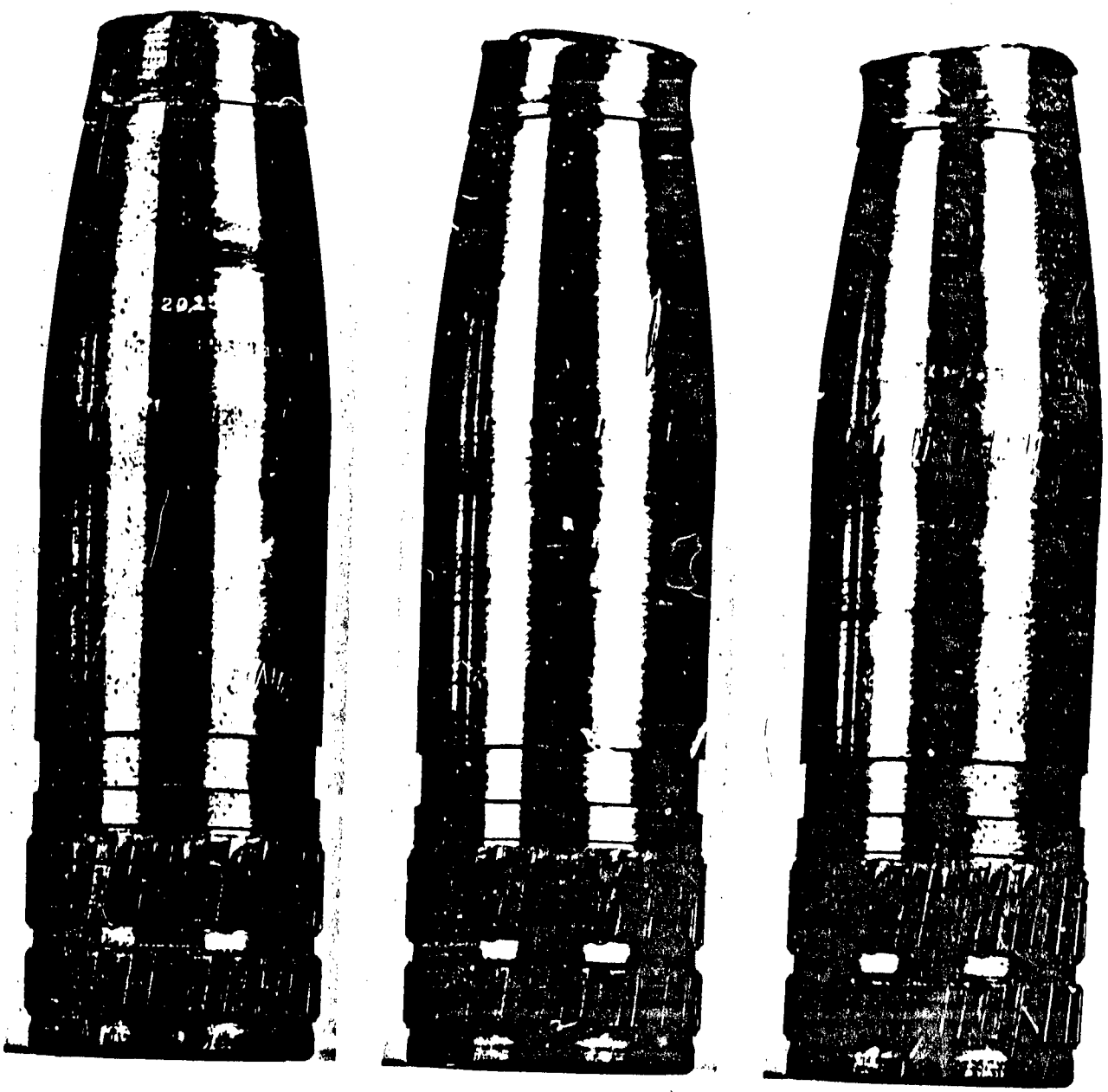
CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"15 AA Projectile Type EX 1 Mod 0. Projectile No. 2013 (muzzle velocity 3408 ft./sec.).

Figure 21

Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0. Projectile No. 2014 (muzzle velocity 3404 ft./sec.).

Figure 22



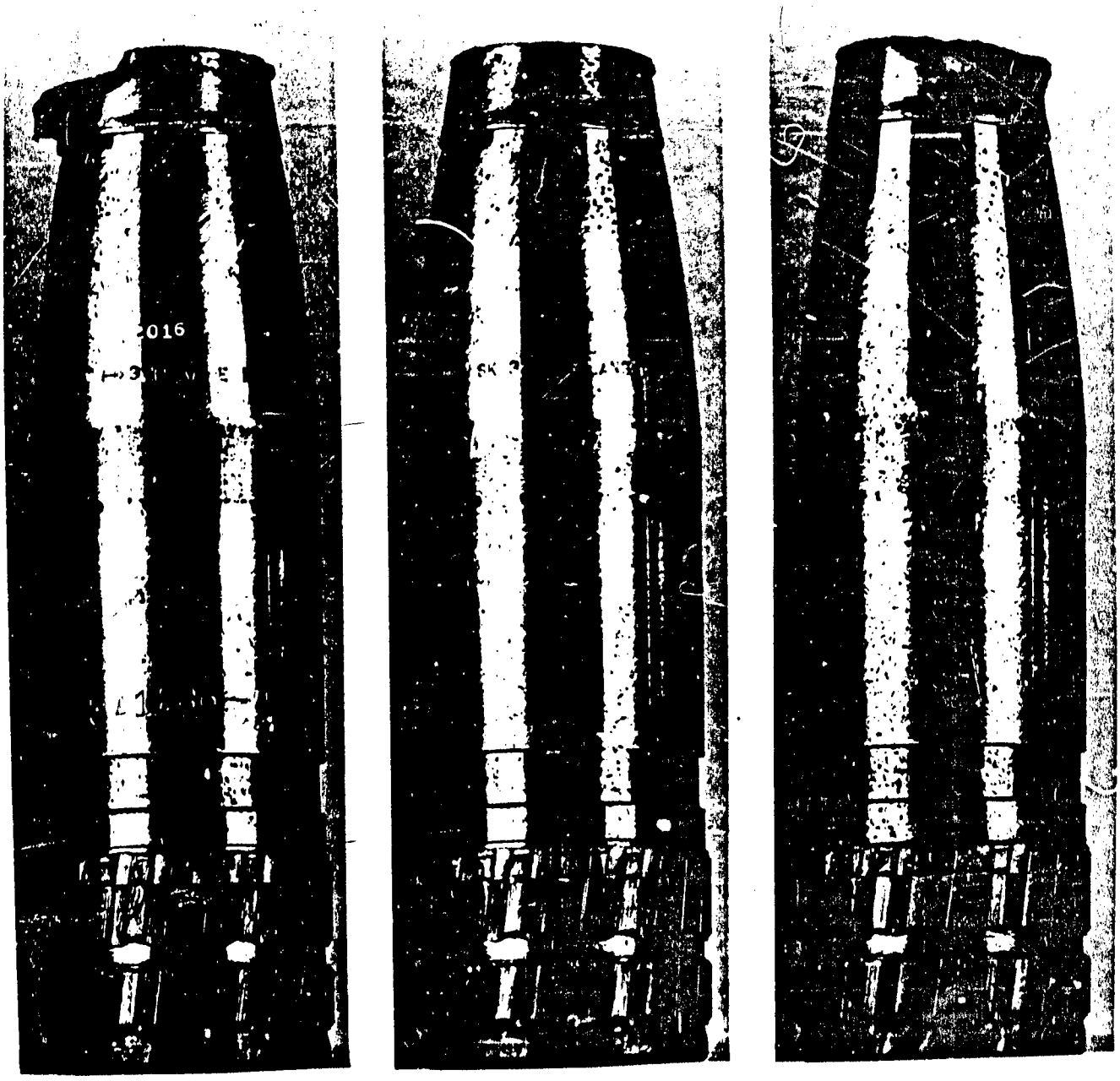
NP9-51564

22 December 1952

CONFIDENTIAL
SECURITY INFORMATION

Three views (120° apart) of recovered 3"15 AA Projectile Type EX 1 Mod 0. Projectile No. 2015 (muzzle velocity 3403 ft./sec.).

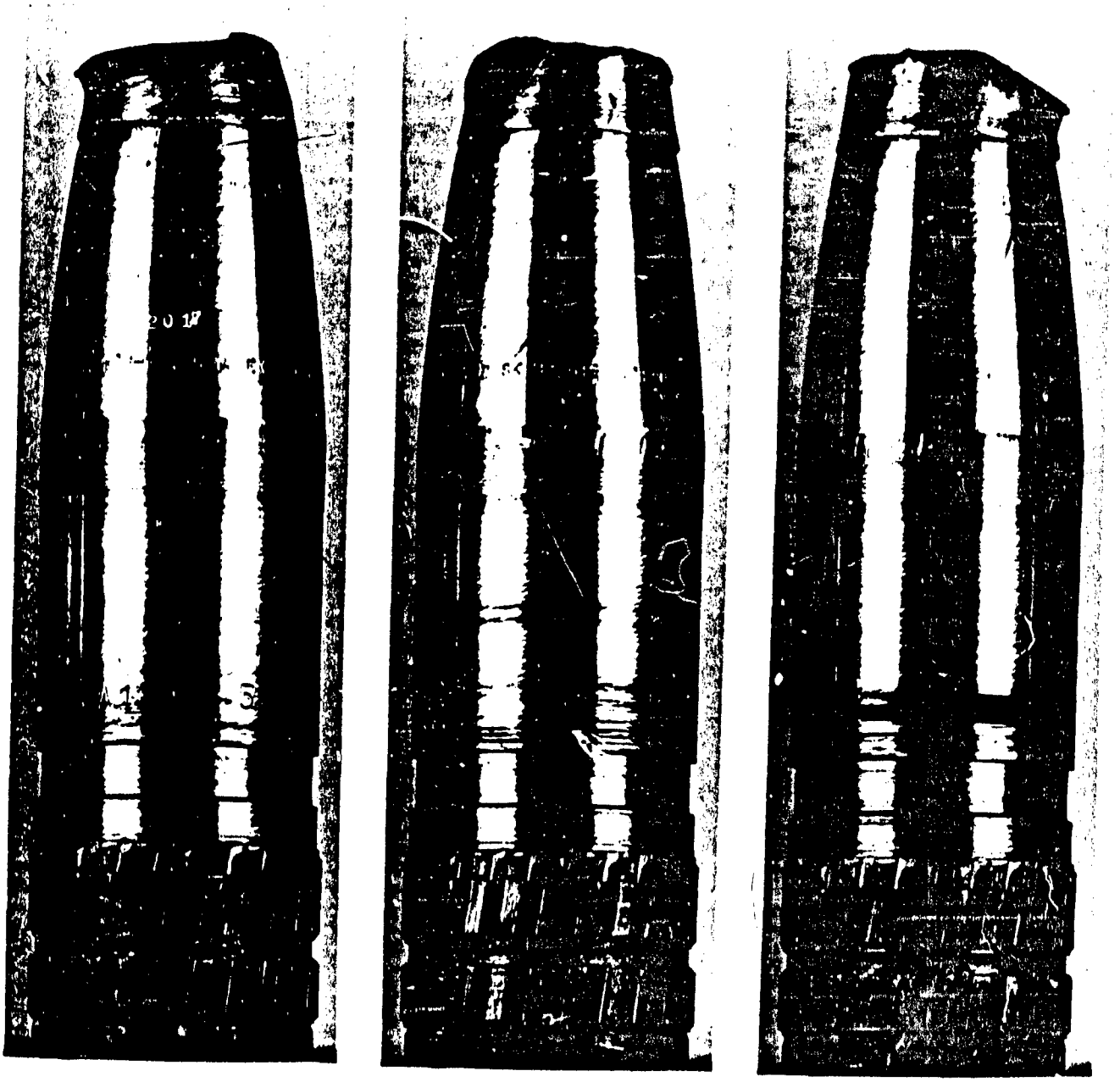
Figure 23



NP9-51565 22 December 1952 CONFIDENTIAL SECURITY INFORMATION

Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0. Projectile No. 2016 (muzzle velocity 3398 ft./sec.).

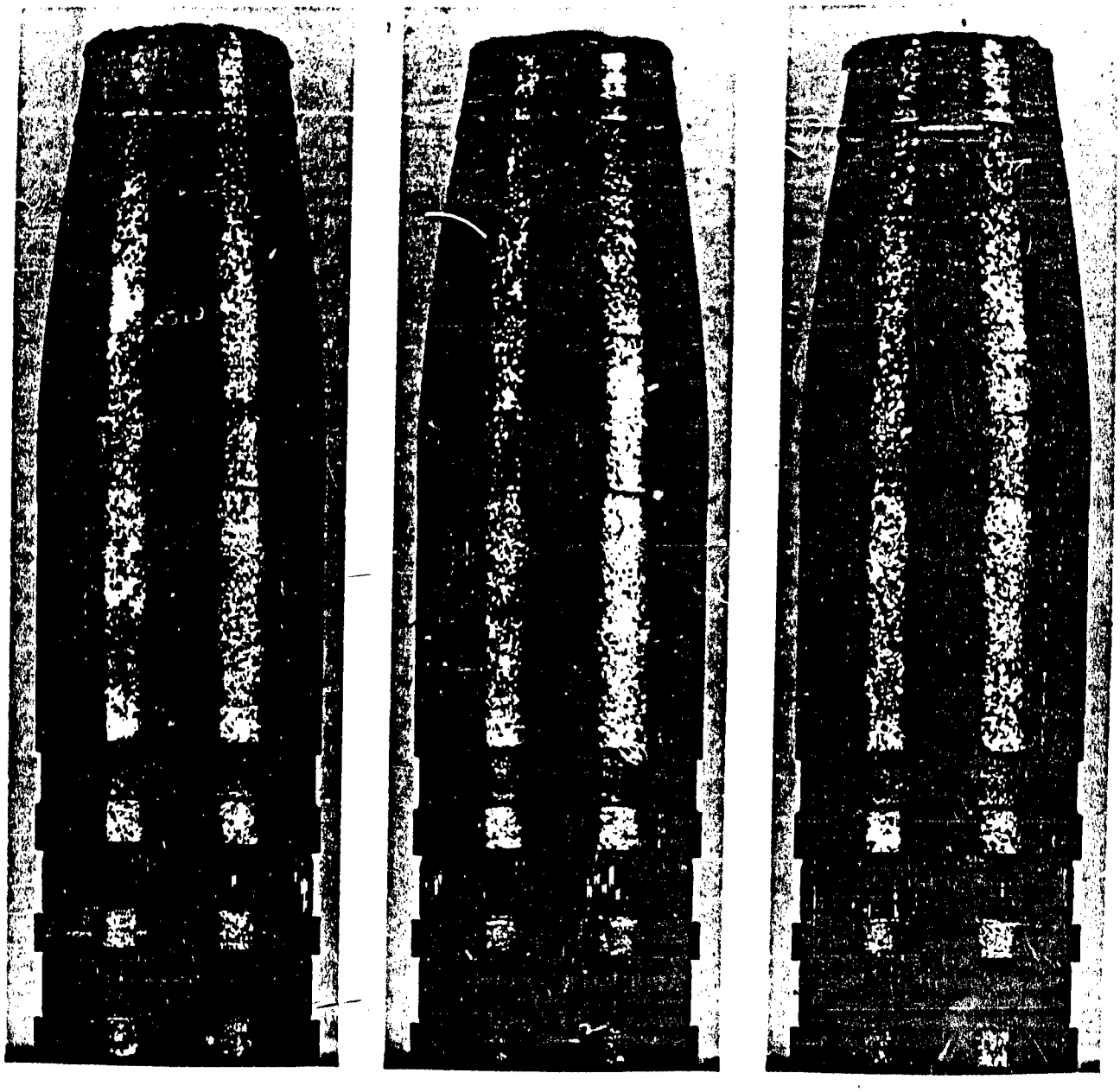
Figure 24



NP9-51566 22 December 1952 CONFIDENTIAL SECURITY INFORMATION

Three views (120° apart) of recovered 3"/15 AA Projectile Type EX 1 Mod 0. Projectile No. 2017 (muzzle velocity 3396 ft./sec.).

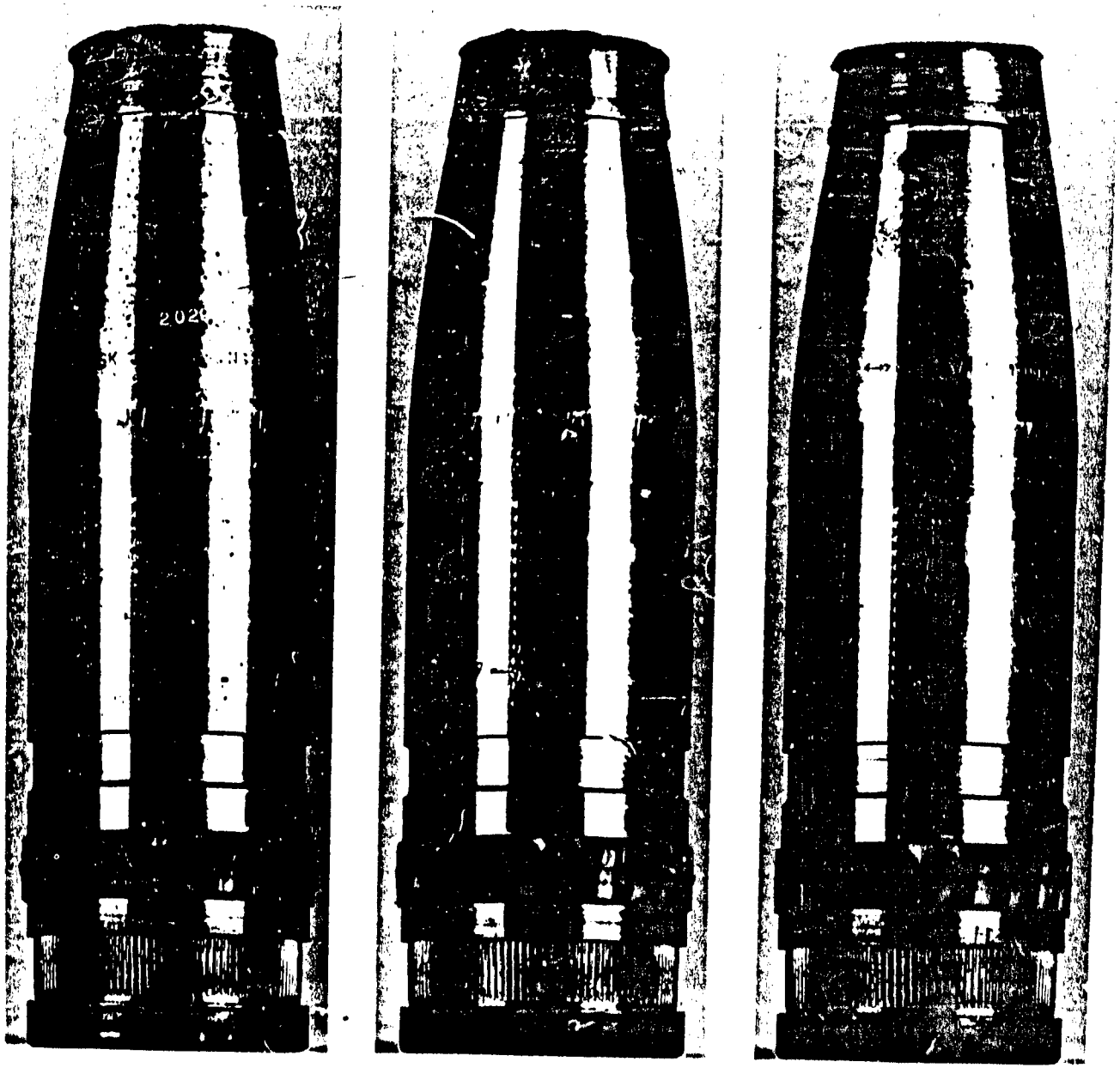
Figure 25



NP9-51955 22 December 1952 CONFIDENTIAL SECURITY INFORMATION

Three views (120° apart) of recovered 3"15 AA Projectile fired with two 0"75 Nylon Bands. Projectile No. 2019 (muzzle velocity 3377 ft./sec.).

Figure 26



NP9-51956 22 December 1952 CONFIDENTIAL SECURITY INFORMATION

Three views (120° apart) of recovered 3"15 AA Projectile fired with two 0"75 Nylon Bands. Projectile No. 2020 (muzzle velocity 3467 ft./sec.).

Figure 27

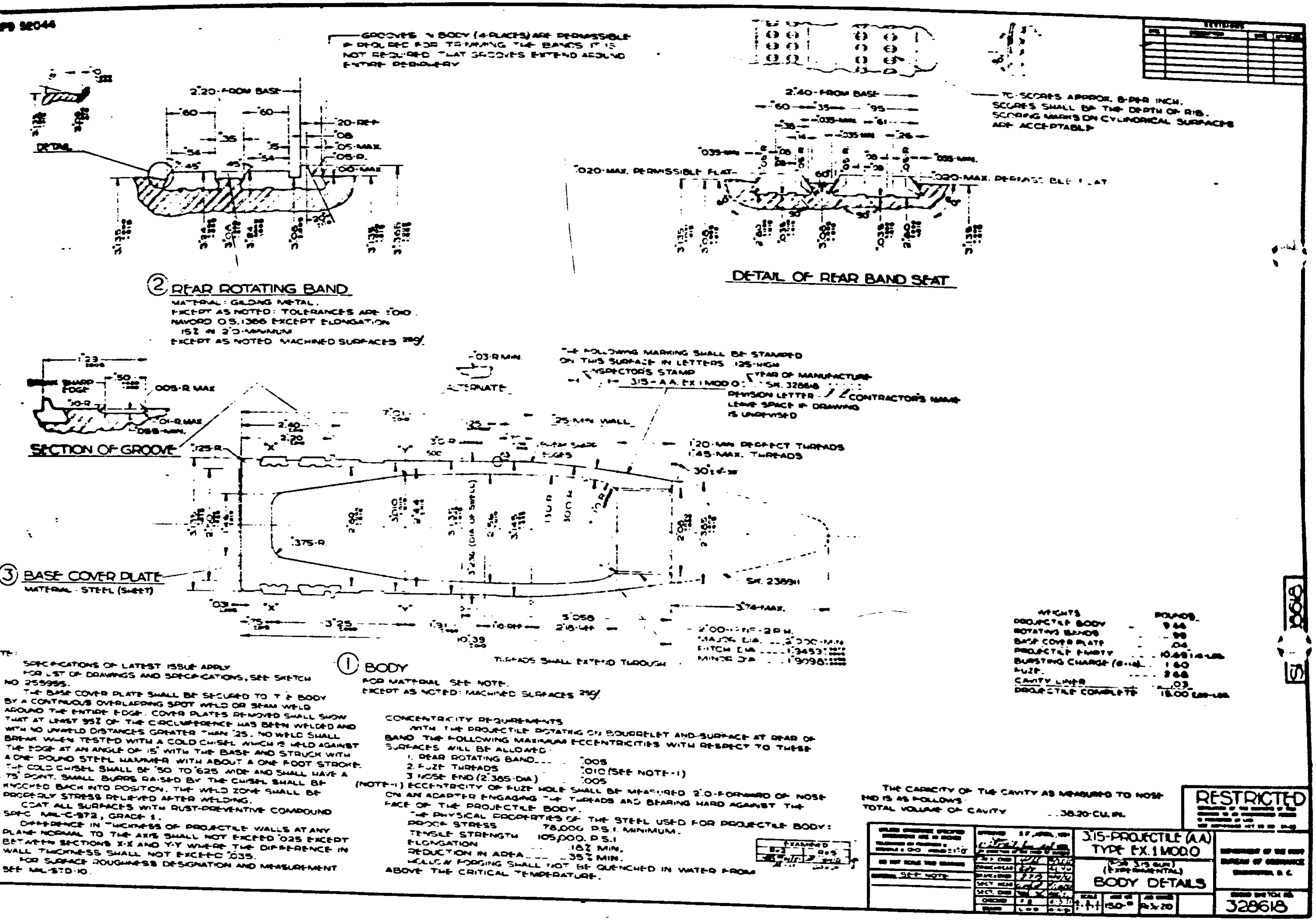

NPG 52044
GROOVES IN BODY (4-PLACES) ARE PERMISSIBLE IF REQUIRED FOR TRIMMING THE BANDS. IT IS NOT REQUIRED THAT GROOVES EXTEND AROUND ENTIRE PERIPHERY
2.20-FROM BASE
DETAIL
2 REAR ROTATING BAND
MATERIAL: GILDING METAL.
EXCEPT AS NOTED: TOLERANCES ARE ±.010
NAVORD O.S.1366 EXCEPT ELONGATION 15% IN 2.0-MINIMUM
EXCEPT AS NOTED MACHINED SURFACES 250/
2.40-FROM BASE
.020-MAX. PERMISSIBLE FLAT
TC-SCORES APPROX. 8-PER INCH. SCORES SHALL BE THE DEPTH OF RIB. SCORING MARKS ON CYLINDRICAL SURFACES ARE ACCEPTABLE
DETAIL OF REAR BAND SEAT
BREAK SHARP EDGE
.005-R MAX
.088-MIN.
SECTION OF GROOVE
.03-R MIN.
ALTERNATE
THE FOLLOWING MARKING SHALL BE STAMPED ON THIS SURFACE IN LETTERS .125-HIGH
INSPECTOR'S STAMP
315-A.A. EX 1 MOD 0
YEAR OF MANUFACTURE
SK. 328618
REVISION LETTER
CONTRACTOR'S NAME
LEAVE SPACE IF DRAWING IS UNREVISED
.25-MIN WALL
.120-MIN PERFECT THREADS
.145-MAX. THREADS
.375-R
3 BASE COVER PLATE
MATERIAL: STEEL (SHEET)
SK. 238911
1 BODY
FOR MATERIAL SEE NOTE.
EXCEPT AS NOTED: MACHINED SURFACES 250/
THREADS SHALL EXTEND THROUGH
2.00-12NS-2RH.
MAJOR DIA.
PITCH DIA.
MINOR DIA.
WEIGHTS POUNDS
PROJECTILE BODY 9.44
ROTATING BANDS .99
BASE COVER PLATE .04
PROJECTILE EMPTY 10.48
BURSTING CHARGE 1.60
FUZE 2.68
CAVITY LINER .03
PROJECTILE COMPLETE 15.00
NOTE:
SPECIFICATIONS OF LATEST ISSUE APPLY.
FOR LIST OF DRAWINGS AND SPECIFICATIONS, SEE SKETCH NO. 259955.
THE BASE COVER PLATE SHALL BE SECURED TO THE BODY BY A CONTINUOUS OVERLAPPING SPOT WELD OR SEAM WELD AROUND THE ENTIRE EDGE. COVER PLATES REMOVED SHALL SHOW THAT AT LEAST 95% OF THE CIRCUMFERENCE HAS BEEN WELDED AND WITH NO UNWELD DISTANCES GREATER THAN .25. NO WELD SHALL BREAK WHEN TESTED WITH A COLD CHISEL WHICH IS HELD AGAINST THE EDGE AT AN ANGLE OF 15° WITH THE BASE AND STRUCK WITH A ONE POUND STEEL HAMMER WITH ABOUT A ONE FOOT STROKE. THE COLD CHISEL SHALL BE .50 TO .625 WIDE AND SHALL HAVE A .75 POINT. SMALL BURRS RAISED BY THE CHISEL SHALL BE KNOCKED BACK INTO POSITION. THE WELD ZONE SHALL BE PROPERLY STRESS RELIEVED AFTER WELDING.
COAT ALL SURFACES WITH RUST-PREVENTIVE COMPOUND SPEC. MIL-C-372, GRADE 1.
DIFFERENCE IN THICKNESS OF PROJECTILE WALLS AT ANY PLANE NORMAL TO THE AXIS SHALL NOT EXCEED .025 EXCEPT BETWEEN SECTIONS X-X AND Y-Y WHERE THE DIFFERENCE IN WALL THICKNESS SHALL NOT EXCEED .035.
FOR SURFACE ROUGHNESS DESIGNATION AND MEASUREMENT SEE MIL-STD-10.
CONCENTRICITY REQUIREMENTS
WITH THE PROJECTILE ROTATING ON BOURRELET AND SURFACE AT REAR OF BAND THE FOLLOWING MAXIMUM ECCENTRICITIES WITH RESPECT TO THESE SURFACES WILL BE ALLOWED:
1. REAR ROTATING BAND .005
2. FUZE THREADS .010 (SEE NOTE-1)
3. NOSE END (2.385-DIA) .005
(NOTE-1) ECCENTRICITY OF FUZE HOLE SHALL BE MEASURED 2.0-FORWARD OF NOSE ON AN ADAPTER ENGAGING THE THREADS AND BEARING HARD AGAINST THE FACE OF THE PROJECTILE BODY.
THE PHYSICAL PROPERTIES OF THE STEEL USED FOR PROJECTILE BODY:
PROOF STRESS 78,000 P.S.I. MINIMUM.
TENSILE STRENGTH 105,000 P.S.I.
ELONGATION 18% MIN.
REDUCTION IN AREA 35% MIN.
HOLLOW FORGING SHALL NOT BE QUENCHED IN WATER FROM ABOVE THE CRITICAL TEMPERATURE.
THE CAPACITY OF THE CAVITY AS MEASURED TO NOSE END IS AS FOLLOWS:
TOTAL VOLUME OF CAVITY 38.20 CU. IN.
RESTRICTED
3.15-PROJECTILE (A.A.) TYPE EX.1 MOD.0
(FOR 3.15 GUN) (EXPERIMENTAL)
BODY DETAILS
328618

FIGURE 28

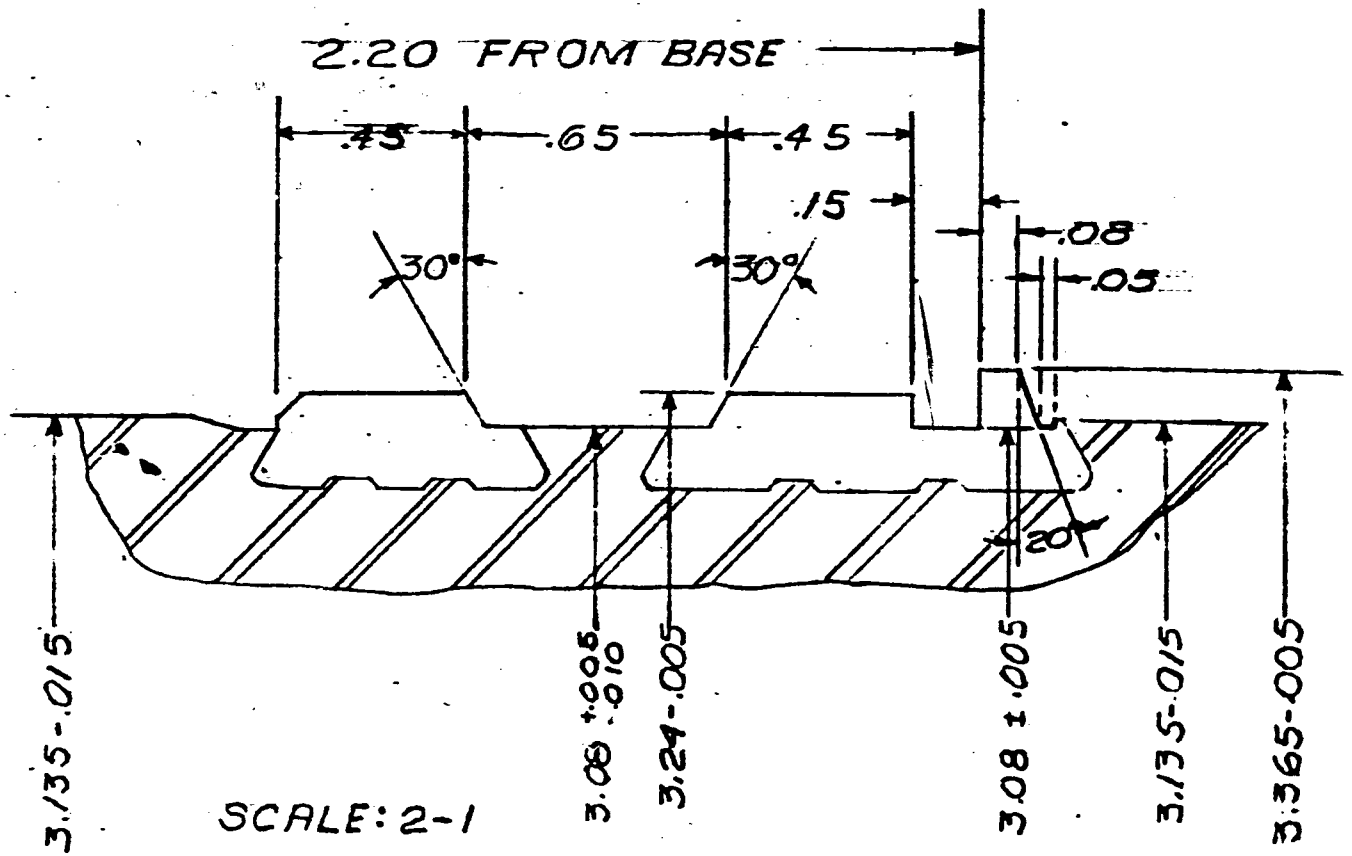


FIGURE 29

REAR ROTATING BAND

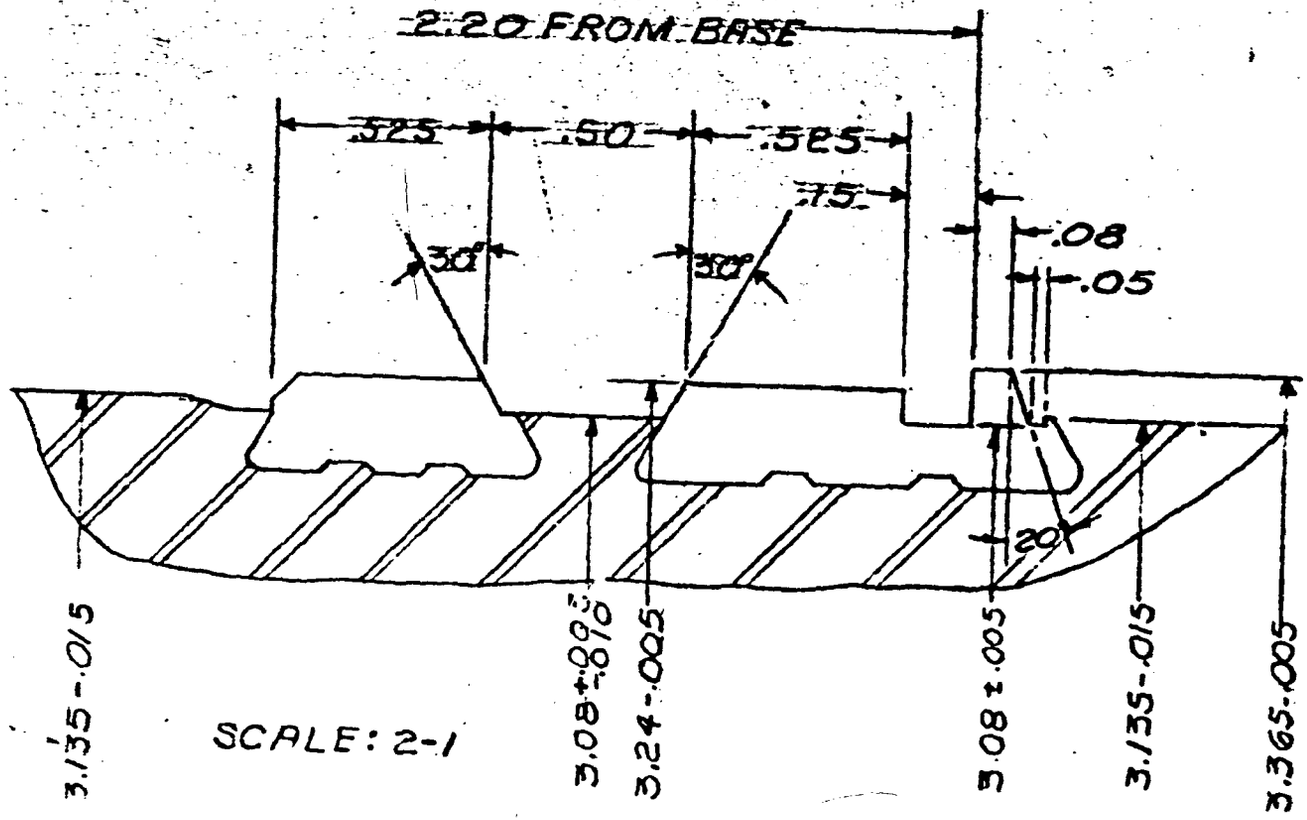
3".15 PROJECTILE TYPE EX I MOD.O
MODIFIED TYPE A

VOLUME WORKING METAL = .510 $IN.^3$

REF: SKETCH E&3b 4-17-52 M.A.S.
BUORD SK. NO. 328618

5-6-52 CWM

D.W.B. NO.
PDI - 342



REAR ROTATING BAND

3"15 PROJECTILE TYPE EX1 MOD.O
MODIFIED TYPE B

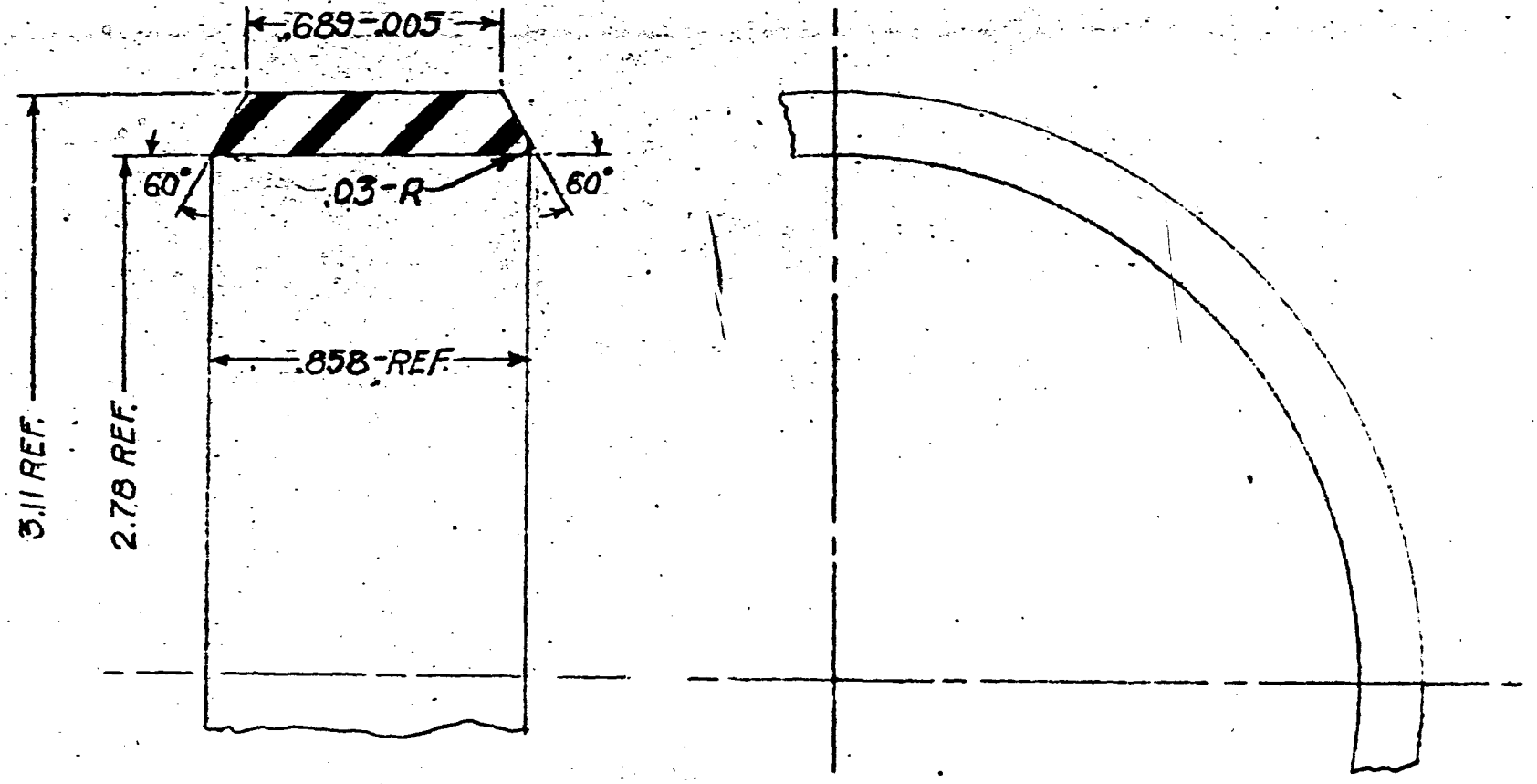
VOLUME WORKING METAL = .578 IN^3

REF: SKETCH Re3b 4-17-52 MAS.
BUORD SK. NO. 328618

5-6-52 cwm

DWG. NO.

FIGURE 31

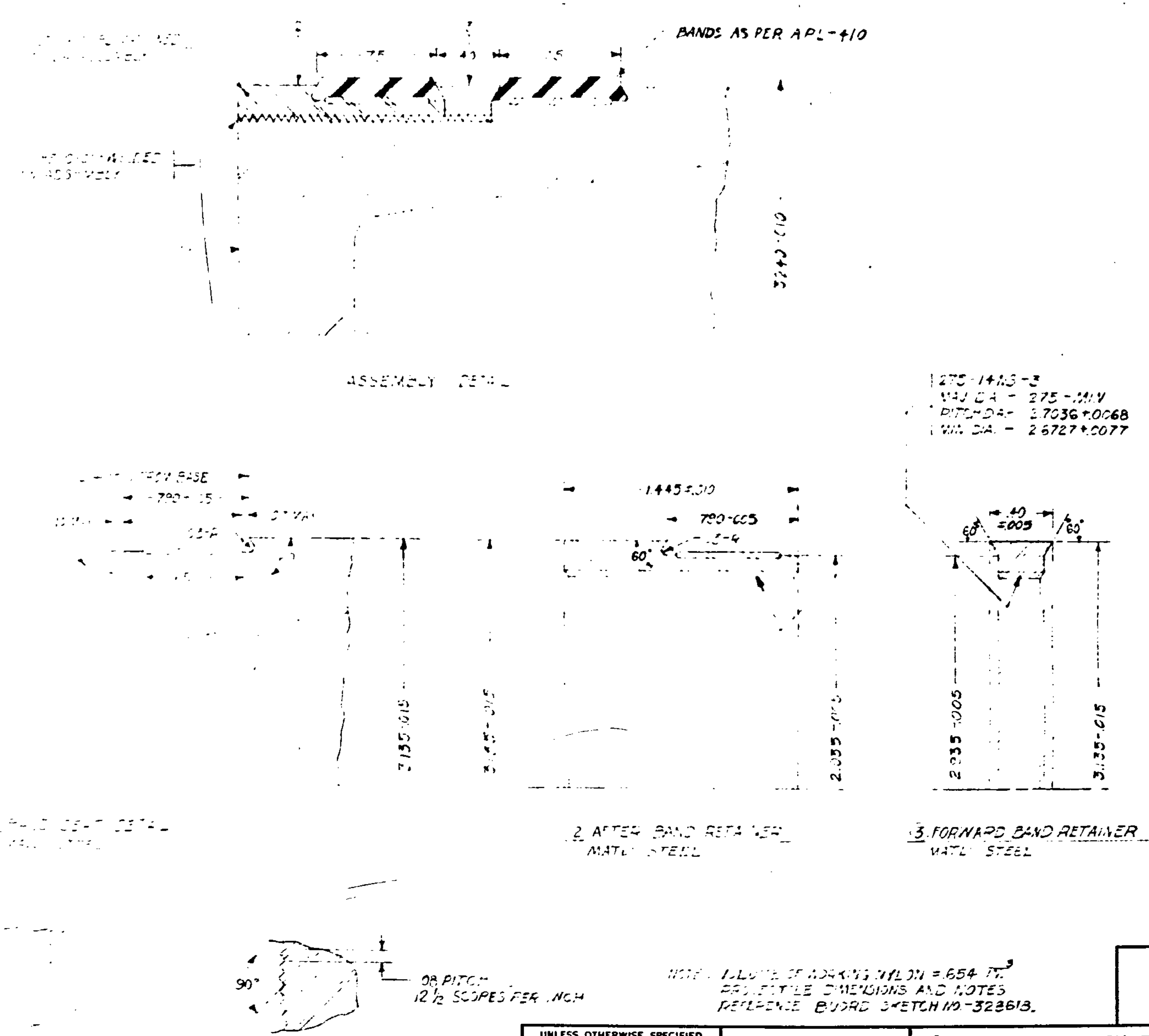


NOTE:
BAND MADE FROM BAND
BLANK A.P.L.-200

NYLON BAND FOR 3.15" PROJECTILE

11/19/52 SCALE 2/1

C.R. NO.
A.P.L.-410



NOTE: VOLUME OF ADDING NYLON = .654 IN.³
PROJECTILE DIMENSIONS AND NOTES
REFERENCE BUORD SKETCH NO. 323613.

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROV.

REVELATION OF THE CONTENTS OF THIS DRAWING TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW. SEE ESPIONAGE ACT 50 USC 31-32

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS ±
DECIMALS ± ANGLES ±
DO NOT SCALE THIS DRAWING
MATERIAL

APPROVED 19 USN
BY DIRECTION OF THE CHIEF OF BUREAU
CHECKED
DRAWN

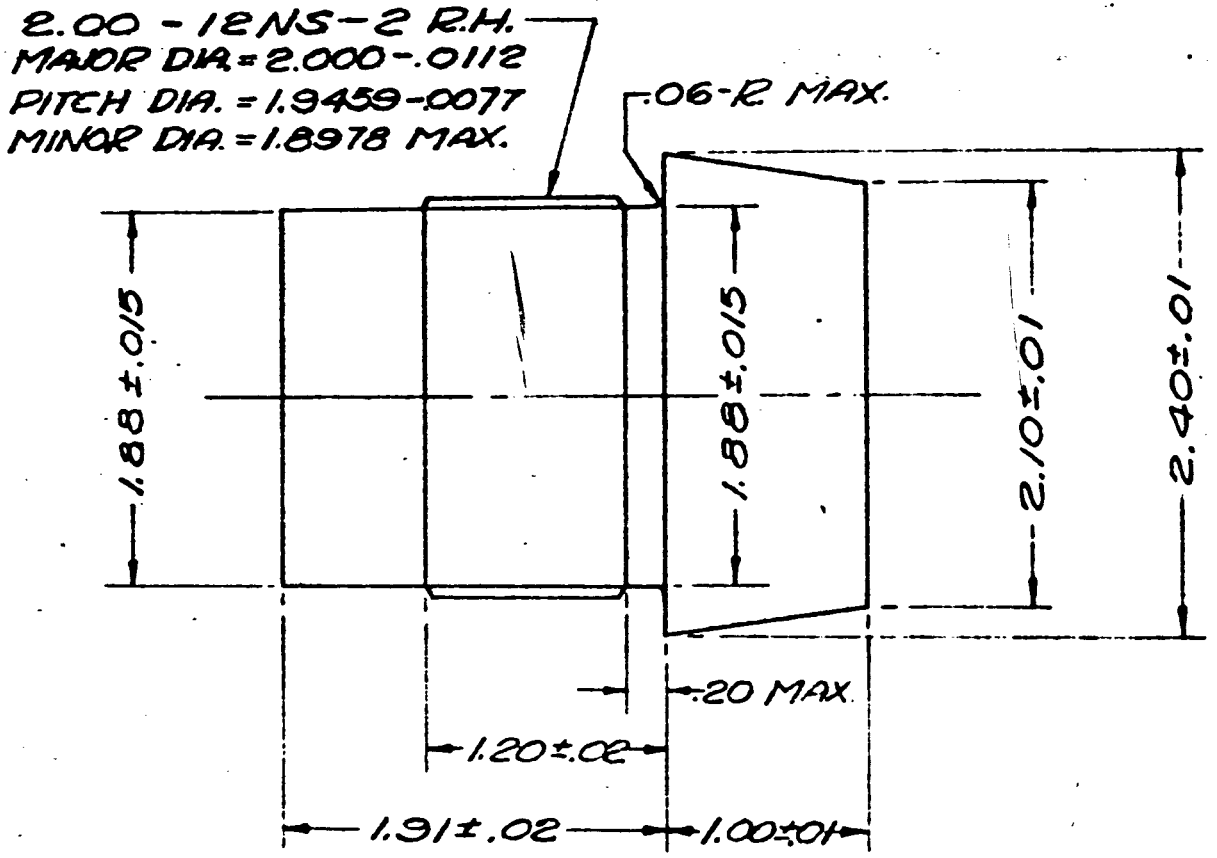
3.15 AA PROJECTILE TYPE EX 1 MOD 0 MODIFIED (NYLON BANDS)

SCALE 2/1 | UNIT WT. | JOB ORDER

BUREAU OF ORDNANCE
DEPARTMENT OF THE NAVY
NAVAL PROVING GROUND
DAHLGREN, VA.

DRAWING NO. APL-424

FIGURE 32



DUMMY NOSE PLUG

MATERIAL: STEEL, FORGED OR ROLLED STOCK.
WEIGHT: 2.68 ± .05 LBS.
NOTE: BREAK SHARP EDGES
REF: SEE BUORD SK. NO. 239269

FIGURE 33

CONFIDENTIAL

SECURITY INFORMATION

APL-107
9/27/49 wot

TABLE X

STAR GAUGE DATA

Lands

Caliber: 3"15
Type: A
Mod: O
Gun No.: 1

Measurement Taken from Muzzle Face

	Distance	X	Y
	183"92	3"310	3"310
	183"42	.250	.248
	182"92	.208	.208
	182"42	.178	.178
	181"92	.157	.157
Origin, O. B.	181"42	.155	.156
1"0 fwd.	180"42	.155	.155
	179"42	.154	.154
	178"42	.154	.154
	177"42	.154	.154
	176"42	.154	.154
	175"42	.154	.154
	174"42	.154	.154
	173"42	.154	.154
	172"42	.154	.154
	171"42	.154	.154
	170"42	.154	.154
12" fwd.	169"42	.154	.154
	165"	.153	
	160"	.153	
	155"	.152	
	150"	.153	
	145"	.153	
	140"	.152	
	135"	.152	
	130"	.152	
	125"	.152	
	120"	.152	
	115"	.151	
	110"	.151	
	105"	.152	
	100"	.152	
	95"	.152	
	90"	.152	
	85"	.152	
	80"	.152	
	75"	.152	
	70"	.152	
	65"	.152	
	60"	.152	
	55"	.152	
	50"	.152	
	45"	.152	
	40"	.152	

Distance	X	Y
35"	3"153	
30"	.153	
28"	.153	
26"	.153	
24"	.153	
22"	.153	
20"	.153	
18"	.153	
16"	.153	
14"	.153	
12"	.153	
10"	.153	
9"	.153	
8"	.153	
7"	.153	
6"	.153	
5"	.153	
4"	.153	
3"	.153	
2"	.153	
1"	.153	
Muzzle	.153	

Origin	3"155	3"156
1" fwd.	.155	.155
12" fwd.	.154	.154
Muzzle	.153	.153
1" aft.	.153	.152
12" aft.	.153	.153

Eq. Ser. Rounds: 20.32
Date: 1 July 1952
Small Diameter: 3"151
Distance: 115"0
Gauged By. B. H. W.

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod O Serial No. 1

TABLE XI

STAR GAUGE DATA

Lands

Caliber: 3"15
Type: A
Mod: O
Gun No.: 1

Measurements Taken from Muzzle Face

	Distance	X	Y
	183"92	3"310	3"308
	183"42	.250	.247
	182"92	.207	.208
	182"42	.175	.177
	181"92	.158	.158
Origin, O. B.	181"42	.153	.152
1"0	180"42	.151	.151
	179"42	.151	.151
	178"42	.151	.150
	177"42	.150	.150
	176"42	.150	.150
	175"42	.150	.150
	174"42	.150	.150
	173"42	.150	.151
	172"42	.150	.150
	171"42	.150	.150
	170"42	.150	.151
12"0	169"42	.150	.150
	165"	.150	.150
	160"	.151	.151
	155"	.150	.150
	150"	.150	.150
	145"	.150	.150
	140"	.150	.150
	135"	.150	.150
	130"	.150	.150
	125"	.150	.150
	120"	.150	.150
	115"	.150	.150
	110"	.150	.150
	105"	.150	.150
	100"	.150	.150
	95"	.150	.150
	90"	.150	.150
	85"	.150	.150
	80"	.150	.150
	75"	.150	.150
	70"	.150	.150
	65"	.150	.149
	60"	.150	.149
	55"	.150	.149
	50"	.150	.149
	45"	.150	.149
	40"	.150	.149

Distance	X	Y
35"	3"150	3"150
30"	.151	.151
28"	.151	.150
26"	.151	.150
24"	.151	.151
22"	.151	.151
20"	.151	.151
18"	.152	.151
16"	.152	.151
14"	.150	.150
12"	.150	.151
10"	.150	.151
9"	.151	.151
8"	.151	.151
7"	.152	.151
6"	.152	.151
5"	.152	.151
4"	.152	.150
3"	.151	.151
2"	.151	.150
1"	.151	.150
Muzzle	.151	.151

Eq. Ser. Rounds: 88.20
Date: 13 August 1952
Small Diameter: 3"149
Distance: 65"
Gauged By: A. D. B.

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod O Serial No. 1

TABLE XII

STAR GAUGE DATA

Grooves

Caliber: 3"15
Type: A
Mod: O
Gun No.: 1

Measurements Taken from Muzzle Face

	Distance	X	Y
	183"92	3"312	
	183"42	.250	
	182"92	.241	
	182"42	.241	
	181"92	.241	
Origin O. B.	181"42	.241	
1"0	180"42	.241	
	179"42	.241	
	178"42	.241	
	177"42	.241	
	176"42	.241	
	175"42	.241	
	174"42	.241	
	173"42	.241	
	172"42	.241	
	171"42	.241	
	170"42	.241	
12"0	169"42	.241	
	165"	.242	
	160"	.242	
	155"	.242	
	150"	.242	
	145"	.241	
	140"	.241	
	135"	.241	
	130"	.241	
	125"	.241	
	120"	.241	
	115"	.241	
	110"	.241	
	105"	.240	
	100"	.240	
	95"	.240	
	90"	.240	
	85"	.240	
	80"	.240	
	75"	.240	
	70"	.240	
	65"	.241	
	60"	.240	
	55"	.240	
	50"	.240	
	45"	.240	
	40"	.240	

Distance	X	Y
35"	3"240	
30"	.240	
28"	.241	
26"	.241	
24"	.241	
22"	.240	
20"	.240	
18"	.240	
16"	.240	
14"	.240	
12"	.240	
10"	.240	
9"	.240	
8"	.240	
7"	.240	
6"	.240	
5"	.240	
4"	.240	
3"	.240	
2"	.240	
1"	.240	
Muzzle	.240	

Eq. Ser. Rounds: 88.20
Date: 13 August 1953
Small Diameter: 3"240
Distance: 105"0
Gauged By: A. D. B.

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod 0 Serial No. 1

TABLE XIII

STAR GAUGE DATA

Lands

Caliber: 3"15
Type: A
Mod: 0
Gun No.: 1

Measurements Taken from Muzzle Face

	Distance	X	Y
	183"92	3"310	3"310
	183"42	.251	.250
	182"92	.209	.208
	182"42	.180	.179
	181"92	.160	.159
Origin, O. B.	181"42	.155	.154
1"0	180"42	.153	.153
	179"42	.152	.152
	178"42	.152	.152
	177"42	.152	.152
	176"42	.152	.152
	175"42	.152	.151
	174"42	.152	.151
	173"42	.152	.152
	172"42	.152	.151
	171"42	.152	.151
	170"42	.152	.151
12"0	169"42	.152	.151
	165"	.152	.151
	160"	.152	.152
	155"	.151	.151
	150"	.151	.151
	145"	.151	.151
	140"	.151	.151
	135"	.151	.150
	130"	.151	.150
	125"	.151	.151
	120"	.151	.151
	115"	.151	.151
	110"	.151	.151
	105"	.151	.151
	100"	.151	.151
	95"	.152	.151
	90"	.151	.151
	85"	.151	.151
	80"	.152	.151
	75"	.151	.151
	70"	.151	.151
	65"	.151	.151
	60"	.151	.151
	55"	.151	.150
	50"	.151	.150
	45"	.151	.150
	40"	.151	.151

Distance	X	Y
35"	3"150	3"151
30"	.152	.151
28"	.152	.152
26"	.152	.152
24"	.152	.151
22"	.152	.152
20"	.152	.152
18"	.153	.151
16"	.152	.151
14"	.152	.152
12"	.153	.152
10"	.152	.152
9"	.152	.152
8"	.152	.152
7"	.152	.152
6"	.152	.152
5"	.152	.152
4"	.152	.151
3"	.151	.151
2"	.152	.151
1"	.152	.151
Muzzle	.152	.152

Eq. Ser. Rounds: 105.53
Date: 2 January 1953
Small Diameter: 3"150
Distance: 55"
Gauged By: A. D. B.

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod O Serial No. 1

TABLE XIV

STAR GAUGE DATA

Grooves

Caliber: 3"15
Type: A
Mod: O
Gun No.: 1

Measurements Taken from Muzzle Face

	Distance	X
	183"92	3"320
	183"42	.256
	182"92	.244
	182"42	.244
	181"92	.244
Origin, O. B.	181"42	.244
1"0	180"42	.244
	179"42	.244
	178"42	.243
	177"42	.244
	176"42	.244
	175"42	.244
	174"42	.244
	173"42	.243
	172"42	.243
	171"42	.242
	170"42	.242
12"0	169"42	.242
	165"	.244
	160"	.244
	155"	.243
	150"	.243
	145"	.243
	140"	.242
	135"	.242
	130"	.243
	125"	.244
	120"	.243
	115"	.243
	110"	.243
	105"	.243
	100"	.244
	95"	.242
	90"	.242
	85"	.243
	80"	.243
	75"	.242
	70"	.242
	65"	.242
	60"	.242
	55"	.242
	50"	.242
	45"	.242
	40"	.242

Distance	X
35"	3"242
30"	.242
28"	.243
26"	.242
24"	.242
22"	.242
20"	.242
18"	.242
16"	.242
14"	.242
12"	.242
10"	.242
9"	.242
8"	.242
7"	.242
6"	.242
5"	.242
4"	.242
3"	.242
2"	.242
1"	.242
Muzzle	.242

Eq. Ser. Rounds: 105.53
Date: 2 January 1952
Small Diameter: 3"042
Distance: 171"42
Gauged By: A. D. B.

Recovery and Range Test of 3"15 AA Projectiles in
3"15/67 Caliber Gun, Type A Mod O Serial No. 1

TABLE XV

STAR GAUGE DATA

Lands

Caliber: 3"15
Type: A
Mod: O
Gun No.: 1

Measurements Taken from Muzzle Face

	Distance	X	Y
	183"92	3"309	3"309
	183"42	.249	.248
	182"92	.208	.208
	182"42	.178	.177
	181"92	.160	.158
Origin, O.B.	181"42	.155	.154
1"0	180"42	.153	.154
	179"42	.153	.153
	178"42	.153	.152
	177"42	.153	.153
	176"42	.153	.152
	175"42	.152	.152
	174"42	.152	.152
	173"42	.152	.152
	172"42	.152	.152
	171"42	.152	.152
	170"42	.152	.152
12"0	169"42	.152	.152
	165"	.152	.152
	160"	.152	.152
	155"	.152	.151
	150"	.151	.151
	145"	.151	.151
	140"	.151	.151
	135"	.151	.151
	130"	.151	.151
	125"	.151	.151
	120"	.151	.151
	115"	.151	.151
	110"	.151	.151
	105"	.152	.151
	100"	.151	.151
	95"	.151	.151
	90"	.151	.151
	85"	.151	.151
	80"	.152	.151
	75"	.151	.151
	70"	.151	.151
	65"	.151	.151
	60"	.151	.151
	55"	.152	.151
	50"	.151	.151
	45"	.151	.151
	40"	.151	.151

Distance	X	Y
35"	3"151	3"151
30"	.151	.151
28"	.152	.152
26"	.152	.152
24"	.152	.152
22"	.152	.152
20"	.152	.152
18"	.152	.152
16"	.152	.152
14"	.152	.152
12"	.153	.153
10"	.152	.153
9"	.152	.153
8"	.153	.153
7"	.153	.153
6"	.152	.152
5"	.152	.152
4"	.152	.152
3"	.152	.152
2"	.152	.152
1"	.152	.152
Muzzle	.152	.153

Eq. Ser. Rounds: 156.53
Date: 19 January 1953
Small Diameter: 3"151
Distance: 155"
Gauged By: B. H. W.

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod 0 Serial No. 1

TABLE XVI

STAR GAUGE DATA

Grooves

Caliber: 3"15
Type: A
Mod: 0
Gun No.: 1

Measurements Taken from Muzzle Face

	Distance	X
	183"92	3"322
	183"42	.257
	182"92	.244
	182"42	.243
	181"92	.243
Origin, O. B.	181"42	.242
1"0	180"42	.242
	179"42	.243
	178"42	.243
	177"42	.243
	176"42	.242
	175"42	.242
	174"42	.243
	173"42	.242
	172"42	.243
	171"42	.243
	170"42	.243
12"0	169"42	.243
	165"	.243
	160"	.243
	155"	.243
	150"	.242
	145"	.242
	140"	.242
	135"	.242
	130"	.243
	125"	.243
	120"	.242
	115"	.242
	110"	.243
	105"	.242
	100"	.242
	95"	.242
	90"	.242
	85"	.242
	80"	.243
	75"	.242
	70"	.242
	65"	.243
	60"	.243
	55"	.243
	50"	.244
	45"	.244
	40"	.244

Distance	X
35"	3"244
30"	.244
28"	.244
26"	.244
24"	.244
22"	.244
20"	.244
18"	.243
16"	.243
14"	.244
12"	.244
10"	.244
9"	.244
8"	.244
7"	.243
6"	.244
5"	.243
4"	.243
3"	.242
2"	.242
1"	.243
Muzzle	.242

Eq. Ser. Rounds: 156.53
Date: 19 January 1953
Small Diameter: 3"242
Distance: 181"42
Gauged By: A. D. B.

[redacted]

Recovery and Range Test of 3"15 AA Projectiles in 3"15/67 Caliber Gun, Type A Mod 0 Serial No. 1

Wire Impression Method of Determining Spin

Two (2) screens are set up 41"5 apart, each screen consisting of a metal frame with wood inserts, holding an array of parallel equidistant vertical copper wires. The spacing of the wires is 1/2" for the first screen and 3/4" for the second. The projectile is fitted with a flat-nosed dummy nose plug or the equivalent, so that after passing through the screens it bears two (2) sets of impressions of the wires. The angle between the two (2) sets of impressions is measured and from this measurement the rifling of the gun, the muzzle velocity, and the velocity at the spin screens, is computed the percentage of nominal spin. It is assumed that over the short distances involved the spin retardation is negligible.

[redacted]

[redacted] NPG F

Recovery and Range Test of 3"/15 AA Projecti
3"/15/67 Caliber Gun, Type A Mod 0 Serial N

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